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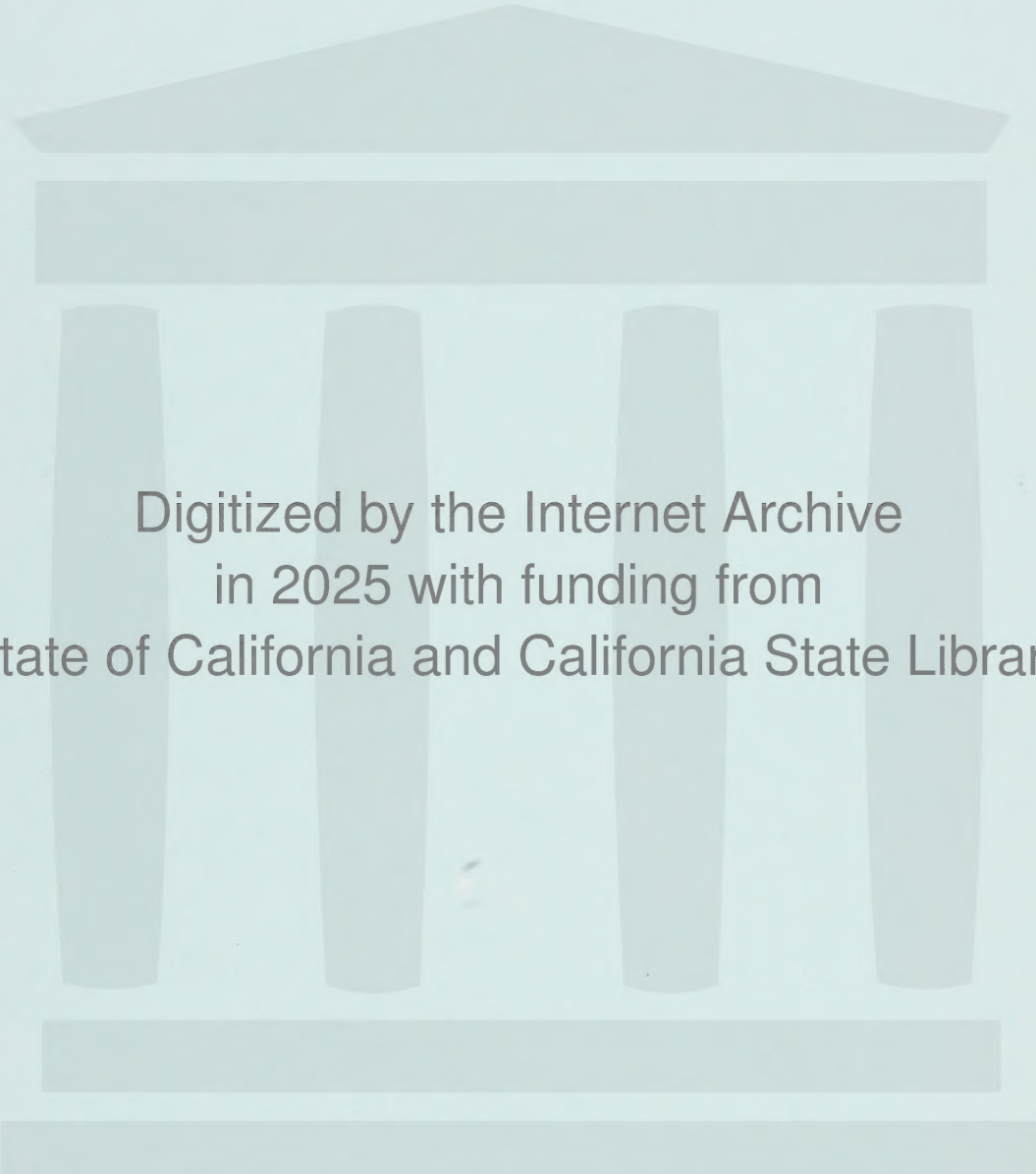
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NOISE

An Element to the General Plan of Merced County

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I introduction

I. INTRODUCTION

Purpose

The State Legislature has declared to be state policy that "all necessary action to provide the people of the state with freedom from excessive noise" be taken. Preparation of the Noise Element of the General Plan is a step in this direction. Section 65302 (f) states in essence that the Noise Element should determine noise levels of existing and proposed transportation facilities and conclusions must be drawn regarding appropriate site or route selection alternates and noise impact upon "compatible" land uses.

The State Law defines the Element in these terms:

- (a) A noise element is quantitative, numerical terms, showing contours of present and projected noise levels associated with all existing and proposed major transportation elements.

These include but are not limited to the following:

- {1} Highways and freeways
- {2} Ground rapid transit systems
- {3} Ground facilities associated with all airports operating under a permit from the State Department of Aeronautics.

The relationship of the Noise Element to the development of the General Plan is as critical as the numerous other elements recently required by the State Legislature, (i.e. seismic safety, conservation and open space, etc.). By inventoring existing and future sources of noise and then planning future land use according to compatibility with these identified areas, a General Plan cannot only be a statement of direction, but a means of protecting the uninformed.

Goals for Noise Control and Abatement

It is a goal of the County of Merced

- to create a healthy environment for its people
- to mitigate existing noise pollution
- to prevent possible detrimental effects caused by excessive noise in all future land use planning
- and to work toward mutual understanding and cooperation with neighboring governmental agencies, including Castle Air Force Base.

II summary

Method of Action

Noise Attenuation Recommendations

Home Construction

Acoustical improvements in construction of walls, windows, doors, floors and ceilings and sound barriers are some of the measures that can be taken to reduce noise within the home.

Comprehensive Planning

Improved approaches to comprehensive planning supplemented by enforcement through zoning, subdivision and noise ordinances can be effective measures towards reducing noise levels.

Noise Encroachment Zones

These zones, much like zones for floodplains, can prohibit or set specific regulations for those areas most affected by noise.

Building Code Attenuation Districts

This approach is another means of requiring added insulation during building construction for specific areas with the highest noise levels.

Environmental Constraint Permit

The Open Space Overlay Ordinance, adopted in 1974, contains regulations for "environmental constraint areas" which can be designated by several factors including noise.

Noise Monitors

This method is suggested as a means of informing and warning the public about damaging noise levels by instruments displayed such as "time and temperature" signs in noisy areas.

III the subject of noise

III. THE SUBJECT OF NOISE

When Does Sound Become Noise?

The rustle of the wind in the trees and the gentle roar of the surf are the sound of nature. Few would say these sounds are without value to mankind, for people often seek such sounds to soothe and comfort them.

Other sounds, such as the roar of a tornado or the crack of thunder, are sounds that serve man well by warning him of potential hazards. If the threat is real, then such sounds are not undesirable and are not without value.

It is only when a sound is not desired that the sound receiver perceives it as noise. This is a subjective experience, however, because what is considered a noise by one listener may be considered desirable sound by another. Even in the same individual, wanted sound on one occasion may be considered noise on another occasion.

Noise Pollution

Noise is considered an environmental pollutant. Contrary to air and water pollution, noise is a waste product of man's way of life that does not remain in the environment for extended periods of time.

Noise, commonly defined as "unwanted sound", is an environmental phenomenon to which man is exposed before birth and throughout life. It has long been known that noise of sufficient intensity and duration can induce temporary or permanent hearing loss, ranging from slight impairment to nearly total deafness.

There are few places left in this world where it is quiet. The sounds of our cities are often all but unbearable. During the day they offend with the hum of air conditioners, the constant din of heavy traffic, screeching wheels, shrieking sirens, the staccato of jackhammers and the roar of jet aircraft.

Our home does not provide a refuge from this constant barrage of noise either. As modern dwellings become more mechanized to take the burden of labor off our hands, they add more of a burden of noise to our ears and nerves. Noisemakers there include garbage disposals and dishwashers, washing machines and dryers; blenders and mixers; refrigerators; radio, television and stereo; vacuum cleaners; and noisy plumbing. The kitchen is the noisiest room in the house because it contains the greatest number of mechanical items and the least amount of surface capable of absorbing noise.

Whether it comes in loud sudden blasts or as a steady high level of sound, noise is loaded with threats to the health of us all. And, ever increasing, it must now be recognized as a plague that has reached epidemic proportions especially in concentrated urban areas.

The subject of noise received nationwide attention and widespread protests when the development of the supersonic transport plane was proposed. The SST, like all planes that fly faster than the speed of sound, creates a sonic boom all along its flight corridor. This noise level has the capability to cause structural damage, and would have been intolerable to those who have to live with it, causing physical and mental harm. The opposition to excessive noise was probably a large factor in defeating the proposed SST in Congress.

Dr. Alexander Cohen, top noise researcher in the U.S. Public Health Service, called the sonic boom a "hidden blessing" because it brought public attention to noise in general. Health professionals, hearing experts, and sound specialists, aided by lawyers, public officials, and concerned private citizens, are leading the fight against the noise. They currently are winning small but significant battles.

Measuring Noise

Noise, or sound, has three important attributes: frequency, intensity, and duration.

Frequency

Frequency is the quality of noise that gives it a pitch, whistle, or roar. It is measured in number of waves or cycles which pass per second. The unit of cycles per second is Hertz (Hz), named after a Viennese researcher of sound who died in 1916. The highest frequency the human ear can hear is 20,000 Hz. Shrieks and whistles which are shriller than this, heard by dogs, bats, and other animals, are "ultrasonic". The lowest groan we hear is about 15 Hz. Sound of frequencies below that is felt by the entire body, rather than sensed by the ears in the usual way.

Intensity

The intensity of sound, or noise, is measured in units known as "decibels", abbreviated as dB, and named in honor of Alexander Graham Bell. Zero dB is the weakest audible sound that can be detected by the ear of a young adult. The decibel is not a linear unit like the inch, but is a logarithmic unit, like those on a slide rule. 10 dB is tenfold the power of 1 dB, and 20 dB is a hundredfold the power of 1 dB. This kind of scale is necessary

because of the incredible range of acoustic power which the human ear handles. It can hear sounds almost as faint as those produced by the thermal motion of molecules. It is comfortable with the 50 dB of a quiet office, but it can also hear a subway train screaming through its underground tunnel at 100 dB, or a jet plane taking off nearby, whining at 120 dB. Even more amazing, the ear can analyze these noises in half-decibel stages and detect very small pitch changes of two or three cycles per second. See Table I on the following page for a sample of noise levels.

It is important to remember that meters cannot measure the qualities of noise to which humans respond. We hear "loudness" and "pitch", while meters measure sound-pressure levels and frequencies, so we should not expect a one-to-one correspondence between meter readings and annoyance or disturbance.

Duration

The length of exposure to noise is of equal importance because even low intensity noise, if it occurs over an extended period of time, can be irritating.

Loudness depends primarily upon the sound pressure of the noise, and to a lesser extent upon the frequency. Similarly, pitch depends primarily upon the frequency of the sound, but it also depends upon the sound pressure as well. Two noises can have the same overall sound-pressure level, but their acoustical energy can be distributed very differently over the audible range of frequencies. (See Table II) Specifically, one noise may consist chiefly of low frequencies while the other noise is composed mainly of medium-to-high frequencies. Although these two noises do have the same sound-pressure level, they probably would not be equally loud, annoying, disturbing, or "noisy" to most people.

A great deal of effort has been expended in developing scales which can be used to relate the physical quantities - level, frequency, duration - to subjective qualities such as loudness or noisiness. Ideally, one would like to combine all the physical quantities describing a noise into a single number that correlates well with the observed subjective response.

The most commonly used scale on sound level meters is the C-scale which gives a flat, equally weighted response across the entire spectrum, and the A-scale which gives less emphasis to low frequency sounds. The A-scale is often used in noise measurements since it provides more weight to the annoying high frequencies and is easily read from a sound level meter.

Sound levels measured on the A-scale and expressed in units of dB(A) correlate reasonably well with people's responses to a variety of noises. Because of the ease with which an A-weighted sound level measurement can be made, and to provide a common scale for comparison purposes, all sound levels cited in this Element will be given in dB(A).

TABLE I

Weighted Sound Levels and Human Response

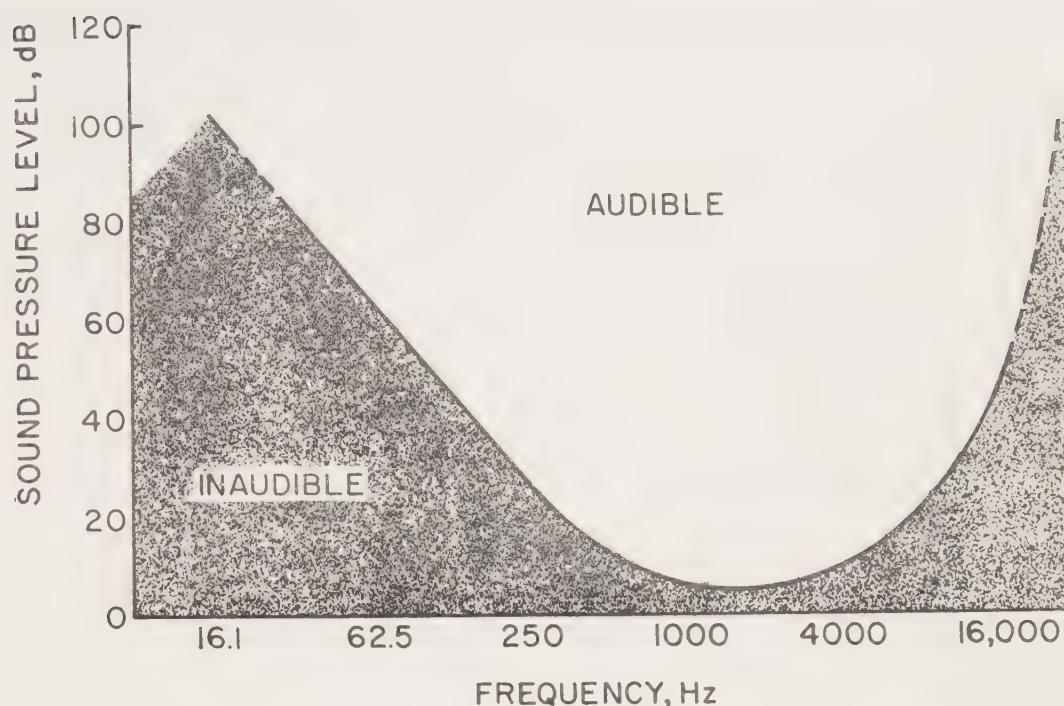
SOUND SOURCE	dB(A)*	RESPONSE CRITERIA
	+150	
Carrier Deck Jet Operation	+140	
	+130	Painfully Loud Limit Amplified Speech
Jet Takeoff (200 ft.) Discotheque Auto Horn (3 ft.) Riveting Machine	+120 +110	
Jet Takeoff (2000 ft.) Shout (0.5 ft.)	+100	Maximum Vocal Effort
N. Y. Subway Station Heavy Truck (50 ft.)	+90	Very Annoying Hearing Damage (8 hrs.)
Pneumatic Drill (50 ft.)	+80	Annoying
Freight Train (50 ft.) Freeway Traffic (50 ft.)	+70	Telephone Use Difficult Intrusive
Air Conditioning Unit (20 ft.) Light Auto Traffic (50 ft.)	+60 +50	Quiet
Living room Bedroom	+40	
Library Soft Whisper (15 ft.)	+30	Very Quiet
Broadcasting Studio	+20	
	+10	Just Audible
	+0	Threshold of Hearing

*Typical A-Weighted sound levels taken with a sound-level meter and expressed as decibels on the scale. The "A" scale approximates the frequency response of the human ear.

Source: Environmental Quality, p. 125.

TABLE II

THRESHOLD OF HEARING AS A FUNCTION OF FREQUENCY

Causes of Noise Pollution

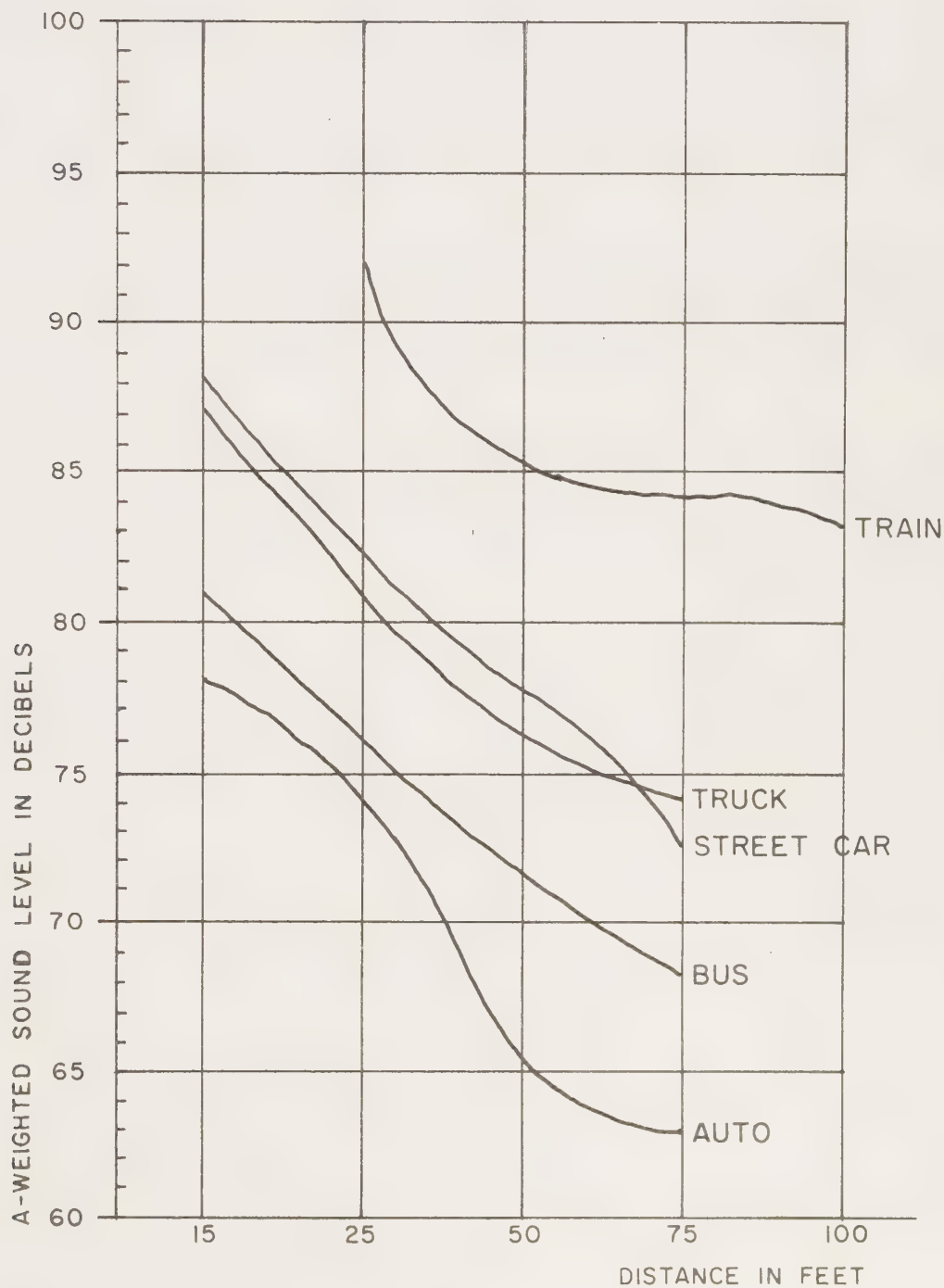
Dr. Vern O. Knudsen, a pioneer in acoustics, recently stated that "the loudest noises to which we are exposed have increased some 20 decibels in the past 20 years, and if this rate of increase continues for another twenty years, they will become lethal". Although some people would question the validity of the use of the word "lethal", there certainly can be no question that noise levels are rising, and noise sources have been increasing.

Transportation

Nearly all activity results in the production of noise. In general, the greatest contributors to high noise levels in the urban environment are virtually all transportation noises: trucks, buses, motorcycles, airplanes and the rail systems. See Table III.

TABLE III

TYPICAL SOUND LEVELS FOR DIFFERENT TYPES OF URBAN TRANSPORTATION



Dissatisfaction with high noise levels which occur in urban areas has always been present. However, only in the last decade has noise been isolated as a pollutant. The level of general traffic noise in some urban areas has risen to such a degree that it constitutes a physical hazard for people who are continually exposed to it. One of the difficulties in enforcing transportation noise control ordinances at the state or local level is that violators are difficult to pinpoint. They are usually mobile, and therefore difficult to apprehend. A truck cruising at 50 miles an hour may produce 70 or 80 dB, perhaps even less, much of it coming from tire and wind noises. However, when accelerating from a stop, the same truck could easily produce over 100 decibels, with most of the noise emanating from the engine exhaust. This kind of a situation makes for difficult enforcement.

Noise levels vary from night to day. A recent report on London traffic noise found that maximum noise levels observed between 7:00 a.m. and 6:00 p.m. were between 65 and 75 dB(A) for 80% of the time in the areas measured. While noise levels were generally lower at night, noise is more annoying at night than during the day because of the lower ambient level.

Studies of traffic flow have shown that low speed non-stop traffic has the lowest overall noise level. High speed non-stop traffic has the highest average noise level, while stop-and-go traffic exhibits the highest momentary peak noise levels. Weather conditions also may affect traffic noise, but little data is available in this area.

The noise transmitted outside a moving automobile generally is dominated by engine inlet and exhaust noise at low speeds, and tire noise at high speeds. The loudest potential noises on an automobile are quieted by an air filter on the engine air inlet, and a standard muffler on the exhaust.

Sports cars generally are several dB louder than passenger cars, and motorcycles are roughly 15 dB noisier. A substantial portion of motorcycle noise is transmitted through the thin walls of the engine. Since weight is a major factor in motorcycle design, attenuation via thicker walls is an impractical idea. Control of motorcycle noise is clearly an area in need of good applied research to develop innovative solutions.

Large trucks are prominent contributors to highway noise. Trucks powered by diesel engines face different noise problems than those powered by gasoline engines. One cause of this is the higher rotation speed of diesel engines. This causes the fan to be a major noise producer, since fan noise increases very rapidly with an increase in speed. Solutions involving acoustic isolation of the fan have thus far proved unsatisfactory.

Since the introduction of jet aircraft this type of transportation has contributed an increasing proportion of urban noise. Suburban growth has encroached upon established flight paths due to little, if any, control resulting in law suits by homeowners.

TABLE IV

Examples of Noise Levels from Common
Urban Sources

(Actual Measurements in Orange County)

	Average Noise Level, dBA
Freeway Noise	
100' from traffic lane	70 - 75
500' from traffic lane	55 - 60
Aircraft Flyover	
Take-off, F4, 500'	94
Landing, F4, 500'	90
Municipal	
Tractors, 5'	98
Refuse Truck, 5'	90
Compressors, 5'	90
Power Mowers, 5'	96
Residential	
Lawn Mower Motors, 5'	90 - 95
Air Conditioners, 10'	60
Passenger Car, 50'	75
Household	
Rock-n-Roll Band	108 - 114
Food Blender	76
Garbage Disposal	80
Clothes Washer	78
Dish Washer	75
Vacuum Cleaner	75

Domestic Noise

Interior noise in residences has been increasing, not only because some noise sources have gotten louder, but also because construction techniques have changed. Thin walls, poor or no insulation at all, failure to use acoustically favorable materials because of the cost involved, have caused serious noise problems. No provisions were made for construction of dwelling units close to major noise generators. Until a few years ago, mortgage guarantee agencies did not require that homes built close to airports, noisy industry, or even expressways, contain any unusual acoustical improvements. A more aware industry, however, is now requiring such standards to protect their investment.

Effects of Noise

Effects of Noise on Man

There appear to be individual differences in tolerance to noise, and wide differences in tolerance to different kinds of noise. High frequency whines are more difficult to withstand than dull roars, sudden and unexpected sounds cause more reaction than those that are regular or anticipated.

In a quiet environment the sound level will be about 50 dB or less, at 80 dB the level becomes annoying. In some cities the people are commonly exposed to levels of 110 dB or more. Steady exposure to sound at levels of 90 dB or higher is believed to cause loss of hearing. There is evidence that workers exposed to high levels of noise have a higher incidence of cardiovascular disease, ear - nose - throat disorders, and equilibrium disorders than do workers exposed to lower levels of noise.

Noise also effects our eyes, heart and blood vessels. It raises the level of cholesterol in the blood and raises the blood pressure. Even moderate noise causes small blood vessels to constrict and impede the blood flow. Noise inflicts stress, tension, and sometimes intolerable nervous strain. People become more irritable, unsociable and quarrelsome.

A sonic boom can make your heart skip a beat, and the pit of your stomach may tighten. Dr. Irving Fish, assistant professor of neurology at New York University's Medical School, says "Sufferers from diseases such as heart trouble, asthma, ulcers and gastrointestinal spasma may all be adversely affected by prolonged or sudden noise. Cardiac patients are particularly vulnerable. Loud noises, such as a bursting paper bag close to the ear, the backfire of a truck, the blast of an auto horn, or a sonic boom, may produce an autonomic response which can bring on a seizure in a heart patient. Chronically noise-interrupted sleep can have violent effects, particularly on aged or sick people. Dr. Julius

Buchwald, a psychiatrist at Downstate Medical Center of the State University of New York, testifying before a state legislative committee on jet noise, cited paranoid delusions, hallucinations, suicidal and homicidal impulses as some of the possible consequences.

The following list contains sound pressure levels at which significant physiological and psychological changes have been reported to occur.

TABLE V

Noise Symptoms

	dBA
No noise adaptation possible	90
Marked physiological changes	90
Diminished work capacity, errors in observation, efficiency, concentration, and attention span	90
Noise generally should not be exceeded regardless of duration	88
Community complaint threshold level	82-92
Threshold level at which temporary hearing loss can occur in some persons	80-85
Functional hearing loss	80
Continuous exposure unsafe	70
Vaso constriction and pupil dilation	70
Threshold stress response	65
Waking from sleep	60
Alteration in sleep pattern	55

Source: Fresno County Health Department

Effects of Noise on Animals

Acoustic signals play a major role in animals' survival. Loss of hearing has been demonstrated in some species due to noise exposure. The animal that depends on its ears to locate prey could starve if hearing ability decreased, or the animal that depends on hearing to detect and avoid its predators could be killed. Mating signals could remain unanswered, affecting reproduction. Distress or warning calls may not be received, again significantly affecting survival.

There is evidence that noise influences stress responses in some animals, producing neural and hormonal changes affecting urinary, adrenal, and reproductive functions. A single startling event may stop the brooding cycle of wild game birds for an entire season. Continuous noise may mask the detection and avoidance relationship between prey and predator, causing panic type behavior, or may induce population dissipation and migration. Any panic type behavior, such as piling up or huddling, could well lead to problems of survival of an animal. Also, avoidance behavior could restrict access to food or shelter, and could therefore adversely affect an animal's, or even a species' changes for survival.

High level of noise stimulation of laboratory animals for fairly short durations have shown significant effects on sexual function, blood chemistry, and hearing ability.

Effect of Noise on Structures

Steady noise does not seem to affect buildings. However, impulsive noise, like door slamming or sonic boom, is known to cause damage to some structures. Edwards Air Force Base in California carried out a series of experiments, and found that the intensity of the sonic boom and the region on the ground over which the sonic boom will be observed, (known as the "boom carpet"), are dependent on atmospheric conditions and airplane characteristics. The total width of the boom carpet is 20 to 80 miles. Outside of the carpet the passage of the aircraft is heard only as a low-pitched rumble.

It appears that the structures most susceptible to sonic boom loads are: residential, commercial and public buildings. The damage caused by sonic booms is confined to brittle secondary structures, such as window glass and plaster. There is, however, a small probability of a greatly magnified boom (as an aircraft turns and accelerates) striking a building with an exceptionally weak or faulty primary structure. The response depends on the structure's location, size, shape, type of construction, manner of assembly, and state of maintenance. The following are some figures of damage experienced during the experiments carried out by Edwards Air Force Base:

TABLE VI

Percent of Valid Claims for Category of Damaged Element

Type Element Damaged	Percent of Units Damaged
Glass only	37.0
Plaster only	22.0
Glass and Plaster	11.0
Brick-a-brac	18.5
Tiles and fixtures	7.5
Other structural damage	4.0

Apart from damage to structures, avalanches, landslides and cliff failures have also been attributed to sonic booms.

IV noise in the county of merced

IV. NOISE IN THE COUNTY OF MERCED

Sources of Noise

Noise in Merced County comes from a variety of sources; but for the purposes of this report, only major sources affecting a majority of the population will be considered. These sources are all related to transportation and include major streets and highways, railroads, and airports.

Streets and Highways

In an effort to identify present noise levels that occur as a direct result of automobiles, buses, trucks and farm vehicles there are three basic methods available.

Actual Noise Readings

The first method is the measurement of the actual dB(A) by a meter at the source. But this method (although quite accurate) can only produce short term levels and not long term averages.

The HUD Method

Another means of sound level determination was developed by the Department of Housing and Urban Development (HUD). The formula is based upon the average number of light and heavy vehicles per day passing a designated point. The noise levels are ascertained and then applied to prescribed setback distances for residential development. These setbacks determine the number of feet a dwelling can be constructed from the street to avoid excessive noise levels. Unfortunately, the entire formula must rely on traffic data gathered during August of 1973. This is a busy agricultural month when trucks are in use on all of the roads in Merced County. This is hardly representative of the average noise levels experienced during the year and thus categorized many streets as "unacceptable". This rating would mean that a greater setback, than present County ordinances require, would be necessary to lower noise levels to "acceptable" whereby residential development could occur. Even though over 100 areas were inventoried and classified by this method, it was determined that the information would be too misleading, especially in light of a new method that was provided by CalTrans in April of this year.

The L₁₀ Method

The L₁₀ Method, developed by CalTrans, depicts noise levels exceeded 10% of the time (ten percentile or L₁₀ noise level). This system utilizes a noise model whereby a computer developed specific dB(A) levels at certain distances for all of the State and Federal Highways in the County. These calculations are based on the average daily traffic in 1973 with projections to 1995. According to an official of CalTrans, "these contours are a good estimate of existing and future traffic noise in the absence of specific detailed information at specific sites."

In the Appendix A of this report L₁₀ noise contours have been drawn on reproductions of aerial photographs expressed in decibels. They range from 60-90 dB(A) extending only along State and Federal Highways and do not take into consideration the additional sources of noise created by streets, railroads or airports that may be adjacent to the thoroughfare. However, the contours are adjusted for rows of houses, topographic features and foliage that can reduce the noise level from 5 - 10 dB(A). All unincorporated and incorporated communities were inventoried with the exception of Merced. Here, contours were only calculated for the urban fringe area extending approximately one mile in all directions.

Residential development should generally occur in areas where the L₁₀ level is less than 75 dB(A). In other words, 75 dB(A) is exceeded only 10% of each 24 hour day and the noise level is usually low enough, less than 65 dB(A), so as not to disturb sleep and other normal human activities. For residential dwellings, HUD recommends that 65 dB(A) should not be exceeded for more than 8 hours in every 24 hours and classifies this area as "normally acceptable". Noise levels exceeding 65 dB(A) for more than 8 hours require noise attenuation measures that are discussed in Chapter V. Other uses, such as commercial or industrial buildings, that are not as affected by levels higher than 65 dB(A) can be located within these L₁₀ contours without as much potential harm.

Findings

1973

Upon examination of the community maps with superimposed L₁₀ contours (see Appendix A) it appears that in 1973 there were only small amounts of residential development within the 70-80 dB(A) range. The urban areas most affected by noise as determined by this inventory are listed on Table VII with corresponding maximum noise levels that occur within 150 feet of the roadway.

The communities of South Dos Palos, Winton, Le Grand, and Hilmar were not inventoried by CalTrans. However, staff did take decibel readings for maximum levels in October of 1974 and the results were mapped in the same manner as the CalTrans data. These maps appear with the 1973 L₁₀ contour sheets in Appendix A.

1995

The 1995 projected L₁₀ contour levels by CalTrans indicate a general increase of at least 5 dB(A) for the areas listed on Table VII. The result of this increase will push the L₁₀ contours away from the roadway most affecting residences that are 100 - 300 feet from the roadway. This phenomenon is illustrated in the second set of community maps also in Appendix A.

TABLE VII

Maximum L₁₀ Noise Levels* for Selected Areas

Merced County 1973 & 1995

<u>Highway</u>	<u>Area</u>	<u>Maximum L₁₀ Noise Level</u>	
		<u>1973</u>	<u>1995</u>
St. Rt. 99	Merced	75-85 dB(A)	75-90 dB(A)
St. Rt. 99	Atwater	70-85	75-85
St. Rt. 99	Livingston	70-85	75-85
St. Rt. 99	Delhi	70-85	75-85
St. Rt. 152	Los Banos	65-80	70-85

*occurring generally within 150 feet of Highway

Source: CalTrans

Within these areas, there will be individual homes that will be above "normally acceptable" levels as defined by HUD earlier in this chapter. Unless noise attenuation measures are taken, the residents will undoubtedly experience discomfort due to noise during certain periods of the day.

PLEASE NOTE: It is imperative that any new residential development consider these high noise level portions of the community as Potential Hazard Areas. Special consideration should be given to planning and construction of any residential dwellings within these areas in the upcoming years.

Railroads

Merced County has three major railroad lines that cross from the northwest to the southeast. Southern Pacific operates one line in the western portion of the County that passes through Gustine and Los Banos while the second line services Delhi, Livingston, Atwater and Merced. The Santa Fe Company line enters the County near Ballico and passes through Winton, Merced, Planada and Le Grand.

As in the case of airports and roadways, HUD provides a formula that is a tool in assessing the approximate noise levels according to the rating system previously discussed. The system is based upon the number of operations occurring between 10:00 p.m. and 7:00 a.m. only. (see Appendix C.)

Findings

An analysis of the approximate noise levels created by trains for several communities yielded the results that appear in Table VIII. This general analysis indicated that only a small percentage (perhaps 10%) of the homes exposed to noise created by trains were within the "clearly unacceptable" zone. The majority of the affected homes were either "normally unacceptable" or "normally acceptable" due to the shielding effect of trees, topography, buildings and distance from the tracks.

The largest number of residences with the highest average noise levels due to train operations were located in Los Banos and Atwater. (The City of Merced was not inventoried) Smaller communities such as Winton have similar noise levels but affecting fewer people.

Because these are general ratings and individual conditions vary (i.e. prevailing wind direction that carries noise) it would be misleading to attempt to apply the ratings in a more specific manner. Probably the most useful thing that this information can provide (like L_{10} contours) are general planning guidelines for future residential development. If the high noise level areas ("clearly and normally unacceptable") are developed then residential dwellings should either be discouraged or noise attenuation construction standards should be recommended for the individual homes.

The present noise levels created by rail traffic are not expected to increase by any significant amounts for two reasons. First, products related to rail service are bulk items and it is doubtful that growth over the next twenty years will be rapid. Second, the average noise level created by train movement will only increase noticeably after a large rise in the total number of operations.

TABLE VIII

<u>RAILROAD</u>	<u>AREA</u>	<u>HUD RATING</u>	
		<u>Clearly Unacceptable</u>	<u>Normally Unacceptable</u>
25 Southern Pacific (West Line)	Gustine	None	Limited amount in east and west portions to distance of 1020' line of sight exposure 170' sheltered exposure
	Los Banos	Limited amount extreme east and west portions 170' line of sight exposure 85' sheltered exposure	Numerous homes adjacent to Rail Line especially in unsheltered areas east and west portions to distance of 1020' line of sight exposure 170' sheltered exposure
	(East Line)		
	Delhi	None	Limited amount in areas not sheltered 720' line of sight exposure
	Livingston	None	Limited amount in areas not sheltered 720' line of sight exposure
	Atwater	Limited to unsheltered areas along entire area N.E. of tracks 120' line of sight exposure	General occurrence N.E. of tracks for 720' line of sight exposure 120' sheltered exposure
	Merced (Fringe Area)	None	Limited amount N.W. and S.E. portions 720' line of sight exposure 120' sheltered exposure
Santa Fe	Winton	Limited amount along N.W. and S.E. portions in unsheltered areas 170' line of sight exposure	General occurrence thru town in unsheltered areas 1020' line of sight exposure 170' sheltered exposure

TABLE VIII (Contd)

<u>RAILROAD</u>	<u>AREA</u>	<u>HUD RATING</u>	
		<u>Clearly Unacceptable</u>	<u>Normally Unacceptable</u>
Santa Fe	Merced (Fringe Area)	Numerous homes east portion 170' line of sight exposure 85' sheltered exposure	General occurrence in east portion 1020' line of sight exposure 170 sheltered exposure
	Planada	None	General occurrence thru town in unsheltered areas 1020' line of sight exposure 170' sheltered exposure
	Le Grand	None	General occurrence thru S.W. portion of town 1020' line of sight exposure 170 sheltered exposure

Airports

Noise generated by aircraft during landings and takeoffs (operations) has been calculated according to the Noise Exposure Forecast Method (NEF). This is a relatively new method that is utilized by HUD as well as the Air Force. Basically, NEF contours are calculated from average noise levels generated by specific types of aircraft for airport operations and low level flying measuring the degree of community annoyance.* NEF contours are interpreted as follows:

TABLE IX

Site Exposure to Aircraft Noise

Distance from Site to the Center of the Area Covered by the Principal Runways	Acceptability Category
Outside the NEF-30 contour, at a distance greater than or equal to the distance between the NEF-30 and NEF-40 contours	Clearly Acceptable
Outside the NEF-30 contour, at a distance less than the distance between the NEF-30 and NEF-40 contours	Normally Acceptable
Between the NEF-30 and NEF-40 contours	Normally Unacceptable
Within the NEF-40 contour	Clearly Unacceptable

Merced Airport

On the following page NEF contours have been drawn for the Merced Airport. The contour levels indicate according to Table VII that the present and future residential development within the affected area is "normally acceptable" because it lies beyond the NEF-30 contour.

Castle Air Force Base

Castle AFB, located six miles northwest of Merced, is the primary source of noise for the largest portion of the County's population. NEF contours were recently developed by the Air Force for the flight patterns and appear on Figure 2.

*There are several other types of ratings including three popular methods: Community Noise Equivalent Level (CNEL), Composite Noise Rating (CNR), and the L_{dn} Method, that are explained in the Glossary in Appendix B.

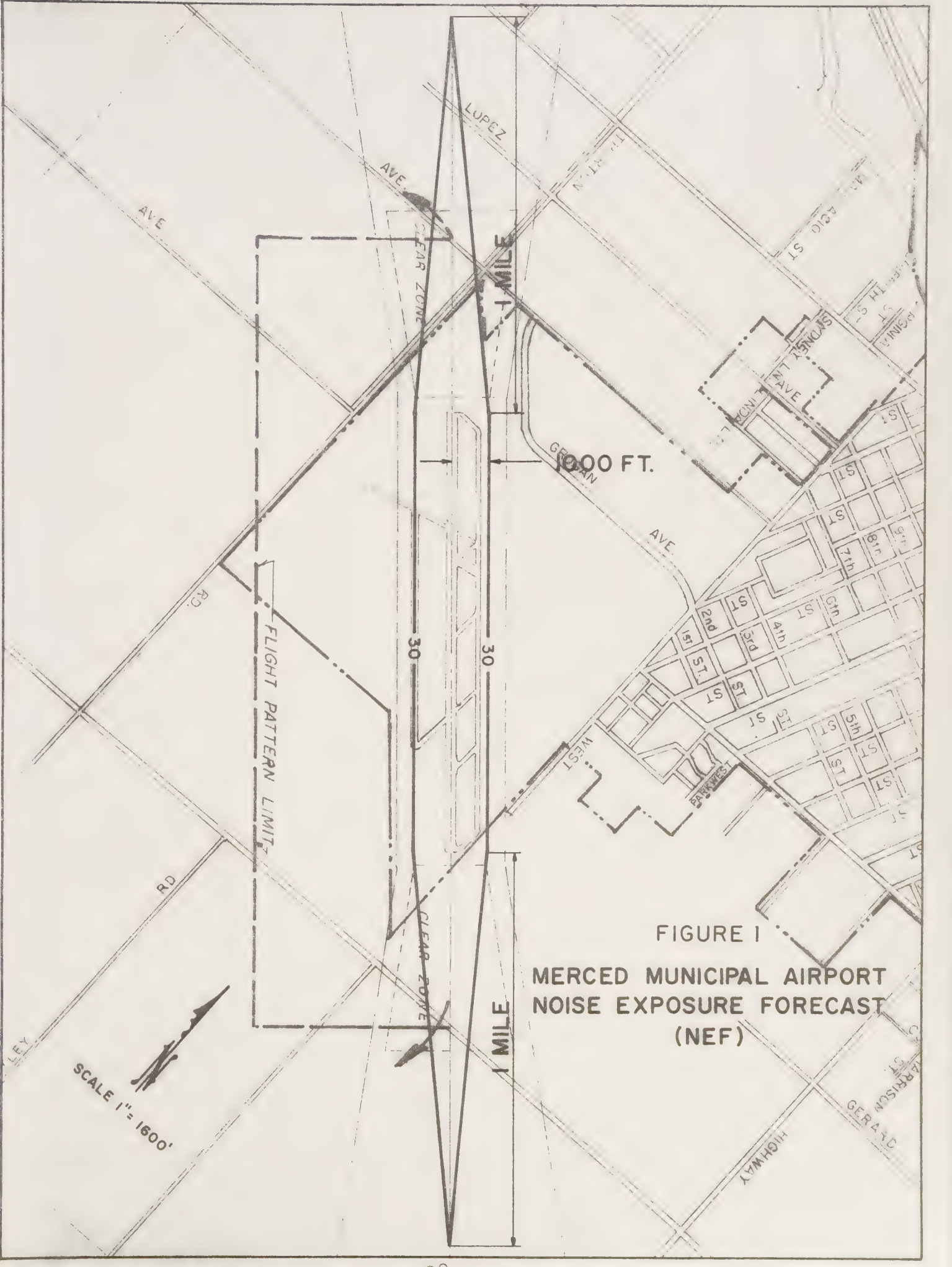


FIGURE 1
MERCED MUNICIPAL AIRPORT
NOISE EXPOSURE FORECAST
(NEF)

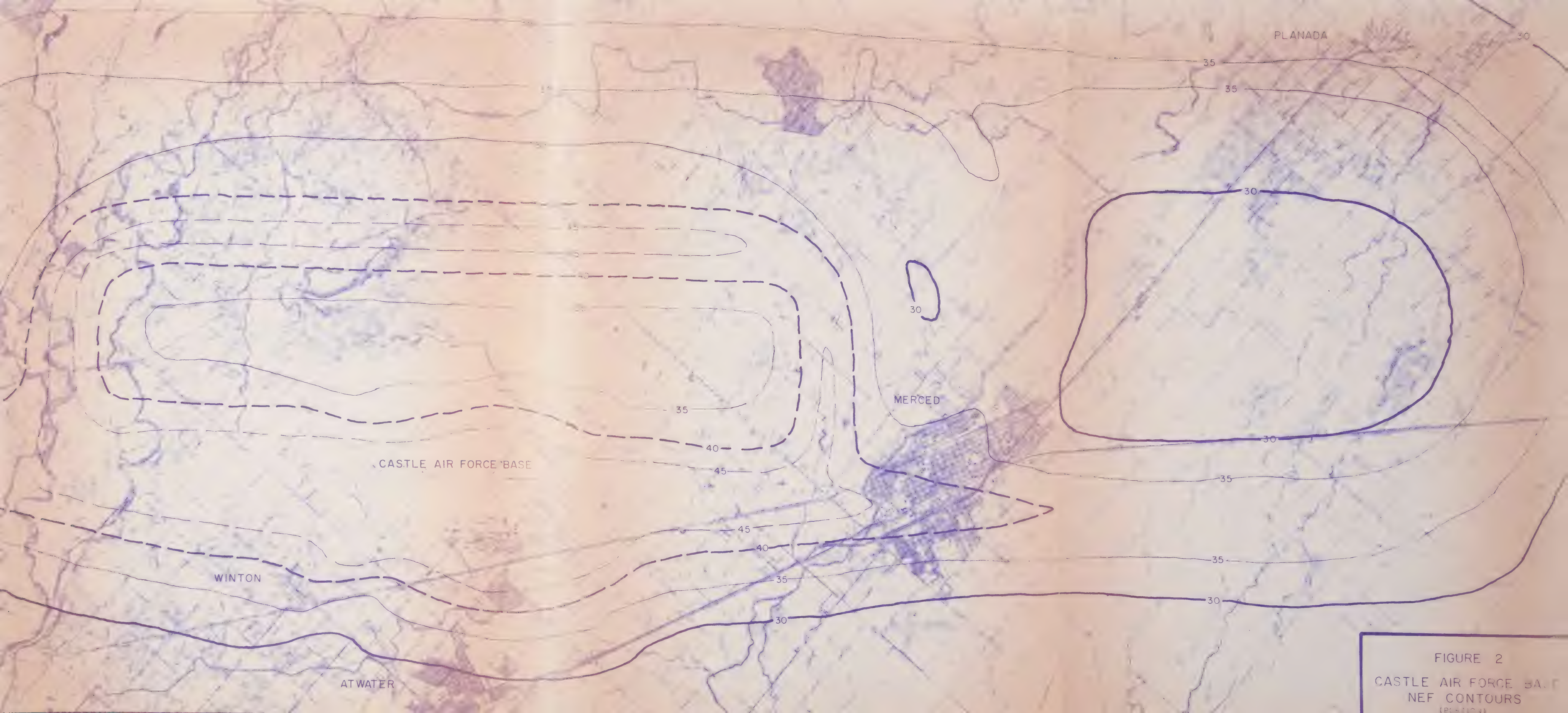


FIGURE 2
CASTLE AIR FORCE BASE
NEF CONTOURS
(POSITION)

The contours between NEF-30 and NEF-40 include the entire area of Merced, Winton, and Planada as well as portions of Atwater. This area is rated under the NEF method as "discretionary--normally unacceptable" (see Table VII). A "clearly unacceptable" rating is given for the zone above NEF-40 which includes approximately one third of Merced.

The impact of the NEF ratings (beyond identifying the fact that one area is often more noisy than another) was not realized until HUD issued a policy decision in late 1974. The decision stated that the Agency would not insure any VA/FHA loans for development lying within the NEF-30 (or greater) contour. At that time eight subdivisions were already in some phase of development and several others in the planning stage. After meetings between local officials and HUD regional representatives, it was decided that the subdivisions in progress prior to the ruling may continue provided that the builders follow specific acoustical regulations imposed by HUD. The requirements pertain mainly to improvements on the roof, wall, ceiling, and floor construction. Any future subdivision activity, not presently waived by HUD, will not be eligible for VA/FHA financing until the environmental impact statement (currently in progress) is completed. Upon review of the EIS, HUD will determine policy for all future developments within the NEF-30 (or greater) contour. Therefore, at this time it is impossible to take the subject of aircraft noise and its effect on County residents any further until these important decisions are made by HUD Regional Office in San Francisco. At such time it may be necessary to amend this element to reflect changes that may result from the final EIS.

Industrial Noise

Industrial noise sources have been subject to greater regulation than other noise, partly because control is easier, and partly because it is mostly in industrial situations that hearing loss and other noise induced traumas are evident. In addition to direct hearing loss, noise has been associated with a higher incidence of fatigue and industrial accidents. Efforts in industry have concentrated on separating personnel from noise sources, and, if necessary, redesigning equipment to produce less noise. With personnel and plant safety officials aware of noise hazards, occupational hearing losses in industry should decline considerably.

Construction

The construction industry has its own unique problems. In addition to high noise levels to which employees are subjected, the public frequently is exposed to noisy construction equipment, and is powerless to escape it. Piledrivers, air compressors and riveting machines top the list of the offenders. Lesser noises produced by continuously operating shovel engines, water pumps, and other small motor driven equipment often reach the industrial maximum for several hours during the day, even though the noise occurs in the open.

As in fixed industry, construction equipment has been modified with heavy duty muffler systems, and also by sound insulation built around the equipment either on a temporary or permanent basis. Restrictions as to operations during specific times of the day have been in force in most large cities for some time. Except on an emergency basis, construction is generally prohibited except during normal working hours. Construction still promises to be a heavy producer of noise, simply due to the nature of the industry.

Recreation

Note should be made of an increasing source of noise: vehicles which have primarily recreational value such as snowmobiles, motorbikes, motorboats and small airplanes. In nearly all situations these vehicles are not used to perform trips from one destination to another. The location of their use, the time of their use, and their ability to penetrate heretofore wilderness or "quiet" areas, have produced a generally negative reaction. Snowmobiles and trailbikes cannot be legally driven on public roads in most states, and there are many lakes where motorboats are prohibited. The future of these and possibly newer recreation vehicles, such as wide-tire all-terrain vehicles and dune-buggies may be less than rosy, as a conservation minded public methodically closes woods and beaches to noisy and potentially destructive recreation vehicles.

V methods of action

V. METHODS OF ACTION

How to Cope with Noise

General Noise Attenuation Measures

The effects of noise on each individual can largely be alleviated or prevented - and should be. We are at the stage of civilization in which we have never made more noise, but also have never had as many means for keeping noise away, and even for preventing it.

The easiest way to protect your ears from noise, when it reaches unbearable levels, is to cover them with your hands. Somewhat more effective are ear plugs or specially designed earmuffs which seal much of the noise out.

The noise of our lives has intensified so steadily at work, in our homes, and on the street, that it would be wise for many people to have their own pocket set of ear plugs or set of ear protectors. Our attitude toward using these ear protectors should be the same as our attitude toward using sunglasses to protect our eyes - a natural precaution. Several states, including California, require workers in noisy industrial settings to wear ear protectors.

Noise that can't be eliminated often can be contained. Noisy machines can be walled in, for instance, so that their noise doesn't affect an entire factory. Noisy industries can be limited to one part of town, so that they do not encroach on residential districts. Busy streets and highways, and even railroads, can be placed in graded cuts, rather than run on the surface, or elevated above it. This keeps traffic noise largely below grade and confined.

Far better than blocking noise is preventing noise. This means that a "think quiet" movement has to pervade all of our technology. There are some signs of a start in this direction in the quiet steel garbage can developed by a noise control engineer at the suggestion of "Citizens for a Quieter City". The can makes a thud instead of a clang when dropped. There are quiet piledrivers which work by humming vibration rather than by banging steam-hammering. There are also designs for quiet vacuum cleaners and quieter power mowers, but these will never be marketed until there is public pressure for them. Machines are redesigned to make them quieter only in response to demands from the public, the courts, or government. After-the-fact control of noisy equipment is usually not only expensive, but also is not as effective as it would be if the machine had been designed for quiet to begin with. It takes far fewer dollars to reduce the decibels at the early stages of design than it does once the machine is operating.

Noise Attenuation in Home Construction

All new residences in California must comply with the Noise Insulation Standards (California Administrative Code Title 25, Chapter 1, Sub-Chapter 1, Article 4, Section 1092) although it is doubtful that this is completely enforced. For added protection, there are relatively simple things that can be done to keep noise from being transmitted into working or living spaces. Many of these are detailed in a HUD booklet entitled "Insulating Houses from Aircraft Noise". They include adding storm windows and doors, weather stripping, calking and sealing cracks and gaps in exterior siding and walls, adding brick veneer or even concrete block to outside walls, installing insulation between, or gypsum board over, open joists in ventilated attic spaces, installing drop ceilings, and placing dampers in fireplaces.

Noise can be walled out. However, when modern construction stopped making inside walls of dense, heavy materials and started using lightweight partition, it lessened the ability of walls to stop noises from traveling from one room or one apartment to another. To compound their noise transparency, these walls are often constructed to hold heating and air-conditioning ducts which open to apartments on both sides, and contain electrical outlets and medicine cabinets placed back-to-back. The results are openings through which noises are readily transmitted.

Property construction techniques can make walls effective barriers to noise. Noise-proof walls use that principle of construction which allows both sides of a wall (or a floor-ceiling) to vibrate freely, without transmitting sounds to the other side. Techniques like these are being used more and more in new office and apartment building construction. One reason is that such quiet construction is more desirable and rentable, and so mortgage agencies specify sound transmission maximums when they lend their money. Another reason is that building codes are slowly being changed to require such construction.

Other action that can be taken to quiet the home include carpets on the floor above your ceiling that will absorb the impact sound of shoes from above. Heavy drapes in front of noisy windows or walls will absorb noise coming through from outside the room. The drapes will also absorb noise inside the room, and reduce the reverberation time (this is the "noise liveliness" of a room which makes sounds linger in the air). Drapes, carpets, upholstered furniture and acoustical walls or ceilings all work to absorb the sound and reduce its reflection and thereby its reverberation time.

An easy way to fight outside noises is to seal windows and doors where noise can easily penetrate. Noisy plumbing can be quieted by inserting cork or neoprene wherever pipes come in contact with studs or other solid structural parts. And finally, replace loose or worn faucet washers to eliminate chattering or whistling.

Planning Based Upon Existing and

Potential Sources of Noise

Comprehensive Planning

Comprehensive planning in conjunction with zoning, subdivision and noise ordinances can be a formidable deterrent to the spread of noise in the most sensitive areas. Land uses that are incompatible because of noise should be separated by distances sufficient to attain acceptable levels. Normally when distance is doubled, noise is reduced by six decibels. Therefore, if planning and some means of implementation are initiated early enough and are not compromised, then noise generators such as industry, freeways, railroads and airports can be effectively isolated from sensitive areas.

The process by which this can begin is discussed in Chapter IV of this element that identified many (but not all) of the major noise sources in Merced County. In addition to the inventory such as railroads, airports and major highways, individual industries should also be measured. The next step would be identification of potential noise sources in the same manner. With this analysis finished, land use plans can be completed that create prescribed distances between noise problem areas. An example of this process in action began in September of 1974 when the Air Force submitted a land use plan for Castle Air Force Base and vicinity. The Air Installation Use Zone Report (AICUZ) contains recommendations for compatible land uses based upon height obstructions, accident potential and a noise exposure forecast (NEF). Looking at the NEF, as an example of the primary criterion, the Air Force developed land use guidelines based upon these potential noise levels. The NEF is essentially a method designed to predict, on the basis of certain acoustical and operational aircraft information, the degree of community annoyance. The FAA has adopted this method for evaluating all airport community noise problems. Beginning at a certain point, the higher the NEF, the greater the annoyance and the less compatible the land use. For example, when the NEF falls below 30, land used for residential purposes is compatible. Between 30 and 40 NEF it is considered "discretionary--normally unacceptable", and when the NEF exceeds 40, no residential land use (single or multiple family) is compatible.*

In ground transportation planning, roadway improvements or new roadways should require noise control solutions if they appreciably change the acoustical character of the adjacent area. Various barriers (e.g., walls, nonresidential buildings, elevation and depression, embankments) can alter the path of noise and thereby reduce the amount of undesired sound reaching the population.

*Although the Noise Exposure Forecast may reliably predict annoyance due to aircraft noise, such annoyance is not a consistent index of environmental health-related problems. Health protection requires more than merely the removal of possible annoyance, since a portion of the population will not respond to community noise intrusion regardless of intensity.

Application of Noise Attenuation Planning

Zoning Regulations

Zoning is one of the most effective tools for application of noise attenuation planning standards. By simply designating zones in accordance with existing and potential noise levels the land use plan can be implemented. Unfortunately, it is not that easy because many additional factors relating to the existing land use must also be weighed equally. Distance from available utilities, water and sewer availability, soil classification and various environmental factors are but a few of the considerations that create different zones. The important point here is that noise potential must not be forgotten and (or) not receive the same consideration as other related factors during the zoning process.

Subdivision Regulations

Review of subdivision regulation is another planning technique. As part of the review, if the situation warrants, a noise expert should be required to prepare noise contours or at least representative noise measurements of the site being developed. Site design solutions may include noise control provisions if the prevailing or anticipated noise within the site exceeds a prescribed sound level. HUD adopted a series of site standards for new residential construction. (See HUD Circular 1390.2)

Noise Encroachment Zones

Since one of the major problems in controlling land uses around airports is the fragmentation of zoning powers among several individual governmental agencies, it would be desirable to develop a mutual overlay zone which could be applied equally to cities and the surrounding County. A precedent for such action may be found in the flood plain zones which have been established, and provide for the delineation of primary and secondary flood plain lines on either side of a streambed. Within these lines structures are either prohibited, or conditions are attached for the use of the development of the properties. The recently issued Castle Air Force Base NEF Contour Map delineates noise encroachment zones, within which it similarly discourages construction or development of incompatible uses. If this is not possible then the County could apply its own overlay zone. These zones can be restricted to only certain uses and might preclude any urbanization of the area.

Building Code Noise Attenuation Districts

Because it is obvious that homes, and other noise-sensitive uses, will continue to be built in noise affected areas simply because of the demand for residential building sites, it is necessary to adopt noise districts within which insulation would be required as a condition of issuing the building permit. Noise districts around railroad yards, freeways, and commercial airports should also be considered. Insulation requirements should be part of the local building codes, without which the building permits cannot be issued. This becomes an even more useful tool when it is linked to an occupancy permit and an appropriate housing code. This solution would avoid one of the problems with noise insulation requirements. In many cases they are not appropriate or needed and simply inflate the costs of housing which is already too high for many families.

Noise Ordinance

Yet another means of controlling noise is by adopting an ordinance which sets regulations on all sources of noise. Many cities throughout California have such ordinances but they are rarely enforced. There must also be a means of actually monitoring sources of excessive noise before regulation can take place. Policemen can carry decibel meters and issue citations but most municipalities and counties are reluctant to budget the money and the time for proper enforcement.

Environmental Constraint Permit

The Merced County "Open Space Overlay Ordinance" adopted in 1974 contains regulations for "environmental constraint areas" designated according to several criterion including noise. If an area experiences considerable noise levels then a permit is required prior to any development to insure that mitigation measures are utilized to protect the residents.

Noise Monitors for Communities

Finally, as a reminder and indicator of urban noise levels, decibel meters have been installed in urban centers where excessive noise levels occur. In this way, citizens not only become more educated as to present noise levels but also can be warned when it approaches dangerous levels. An inexpensive approach might be along the design of the typical "time and temperature sign" often seen on bank buildings.

VI appendix

APPENDIX A

L₁₀ Contour Maps for State Highways in Merced County

(Contours extending through incorporated areas
are not be be construed as part of an adopted
City Noise Element.)



L 10 CONTOUR MAP
for
STATE HIGHWAY 140 & 33

AREA - GUSTINE (west)

Contours extending through incorporated
areas are not to be construed as part
of an adopted city noise element

1973



SC. 1"=660'



L 10 CONTOUR MAP
for
STATE HIGHWAY 140 & 33

AREA - GUSTINE (east)

Contours extending through incorporated
areas are not to be construed as part
of an adopted city noise element

1973





1-10 CONTOUR MAP
for
STATE HIGHWAY 140 & 33

AREA - GUSTINE (east)

Contours extending through incorporated
areas are not to be construed as part
of an adopted city noise element

1995



0 50 100'



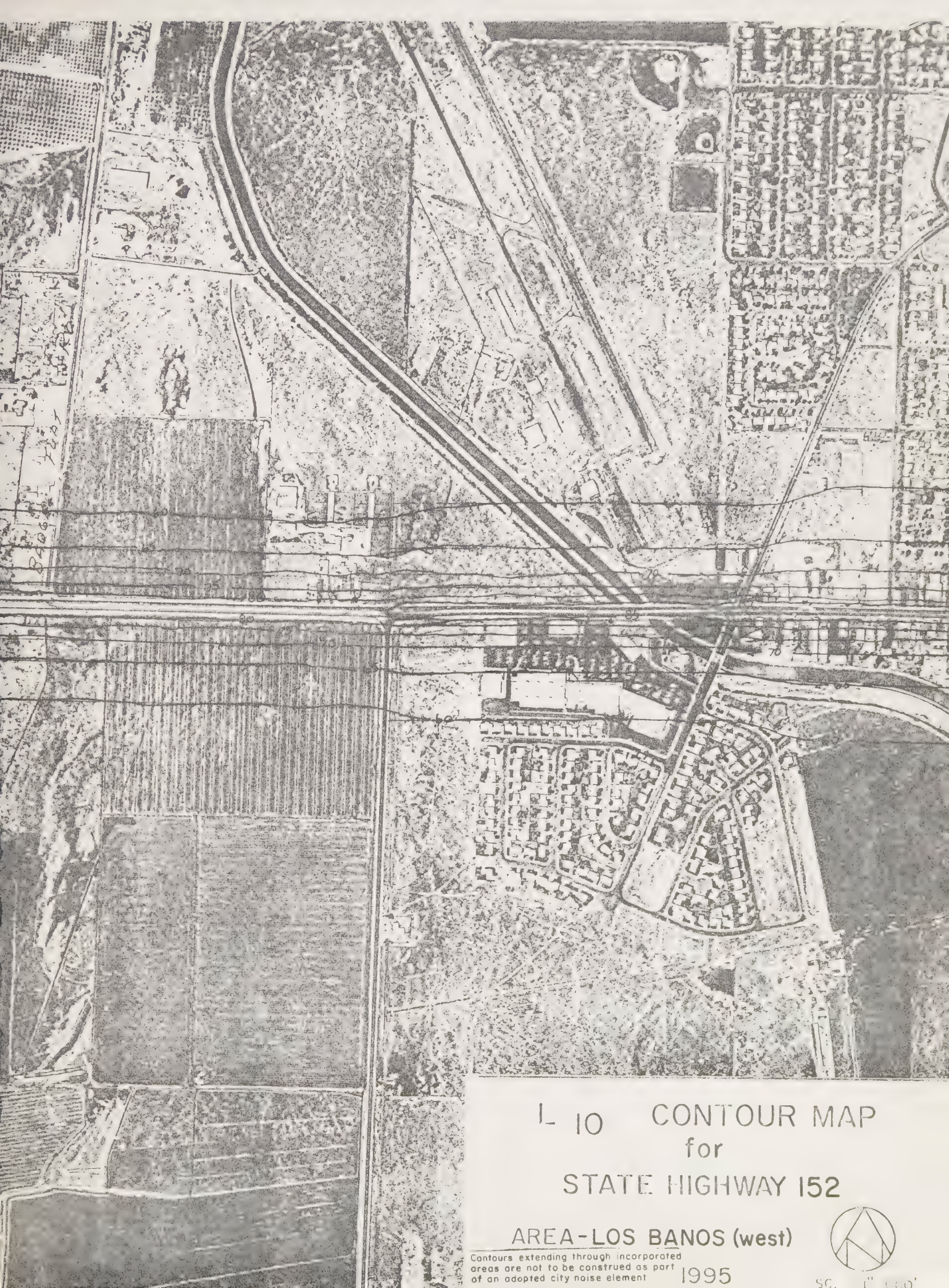
L 10 CONTOUR MAP
for
STATE HIGHWAY 152

AREA - LOS BANOS (west)

Contours extending through incorporated
areas are not to be construed as part
of an adopted city noise element 1973



SC 11-6601



L-10 CONTOUR MAP
for
STATE HIGHWAY 152

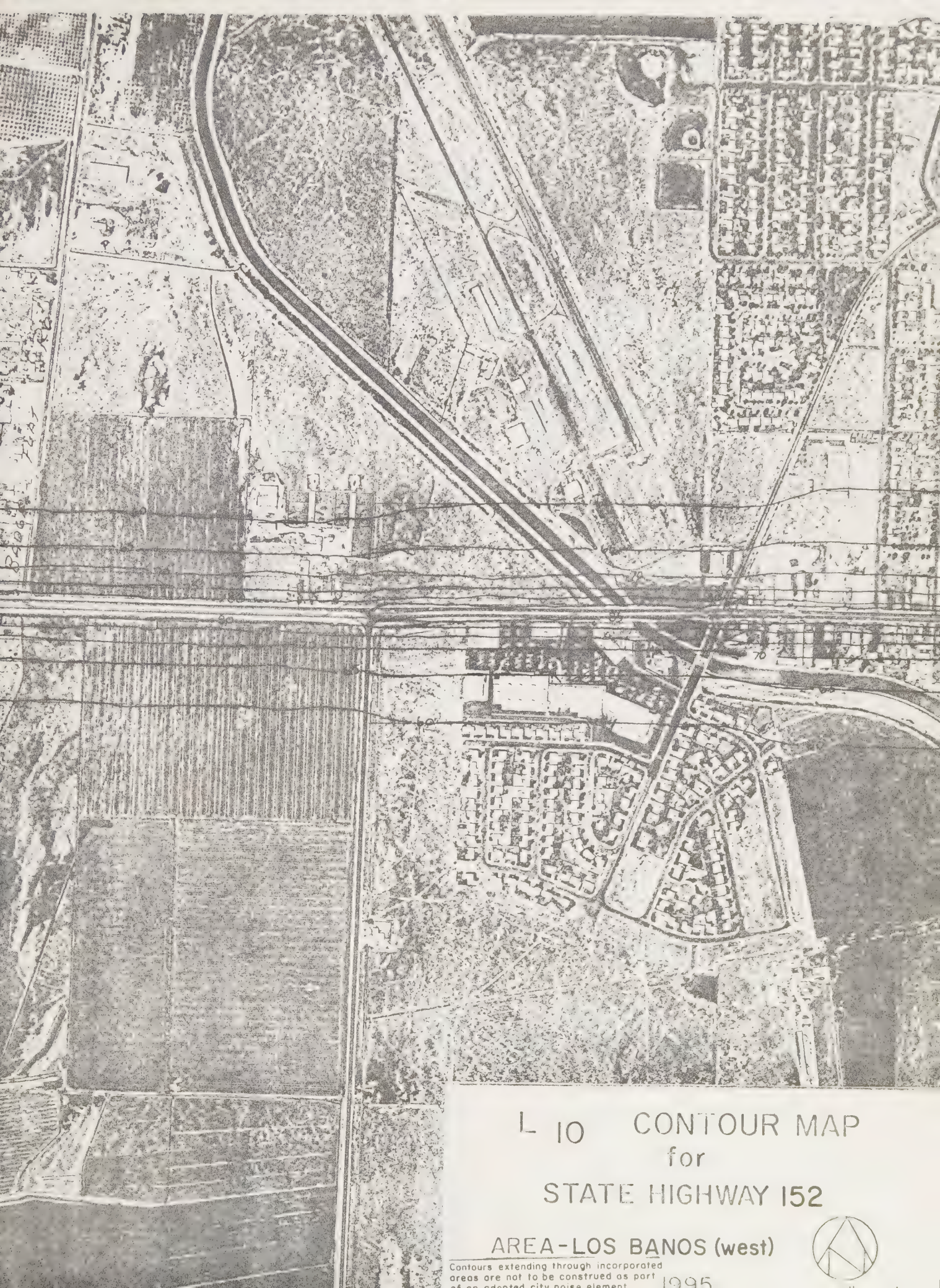
AREA-LOS BANOS (west)

Contours extending through incorporated
areas are not to be construed as part
of an adopted city noise element

1995



SCAG 11111



L 10 CONTOUR MAP
for
STATE HIGHWAY 152

AREA-LOS BANOS (west)

Contours extending through incorporated
areas are not to be construed as part
of an adopted city noise element. 1995





L 10 CONTOUR MAP
for
STATE HIGHWAY 152

AREA-LOS BANOS (central)

Contours extending through incorporated
areas are not to be construed as part
of an adopted city noise element

1973



SC. 1"=660'



L 10 CONTOUR MAP
for
STATE HIGHWAY 152

AREA-LOS BANOS (central)

Contours extending through incorporated
areas are not to be construed as part
of an adopted city noise element

1995



SC. 1"=660'



L 10 CONTOUR MAP
for
STATE HIGHWAY 152

AREA-LOS BANOS (east)

Contours extending through incorporated
areas are not to be construed as part
of an adopted city noise element

1973



SC. 1"=660'



L 10 CONTOUR MAP
for
STATE HIGHWAY 152

AREA - LOS BANOS (east)

Contours extending through incorporated
areas are not to be construed as part
of an adopted city noise element

1995



SC 1"=660'

L 10 CONTOUR MAP
for
STATE HIGHWAY 152 & 33

AREA- DOS PALOS "Y"

1973



50' 1" 60'



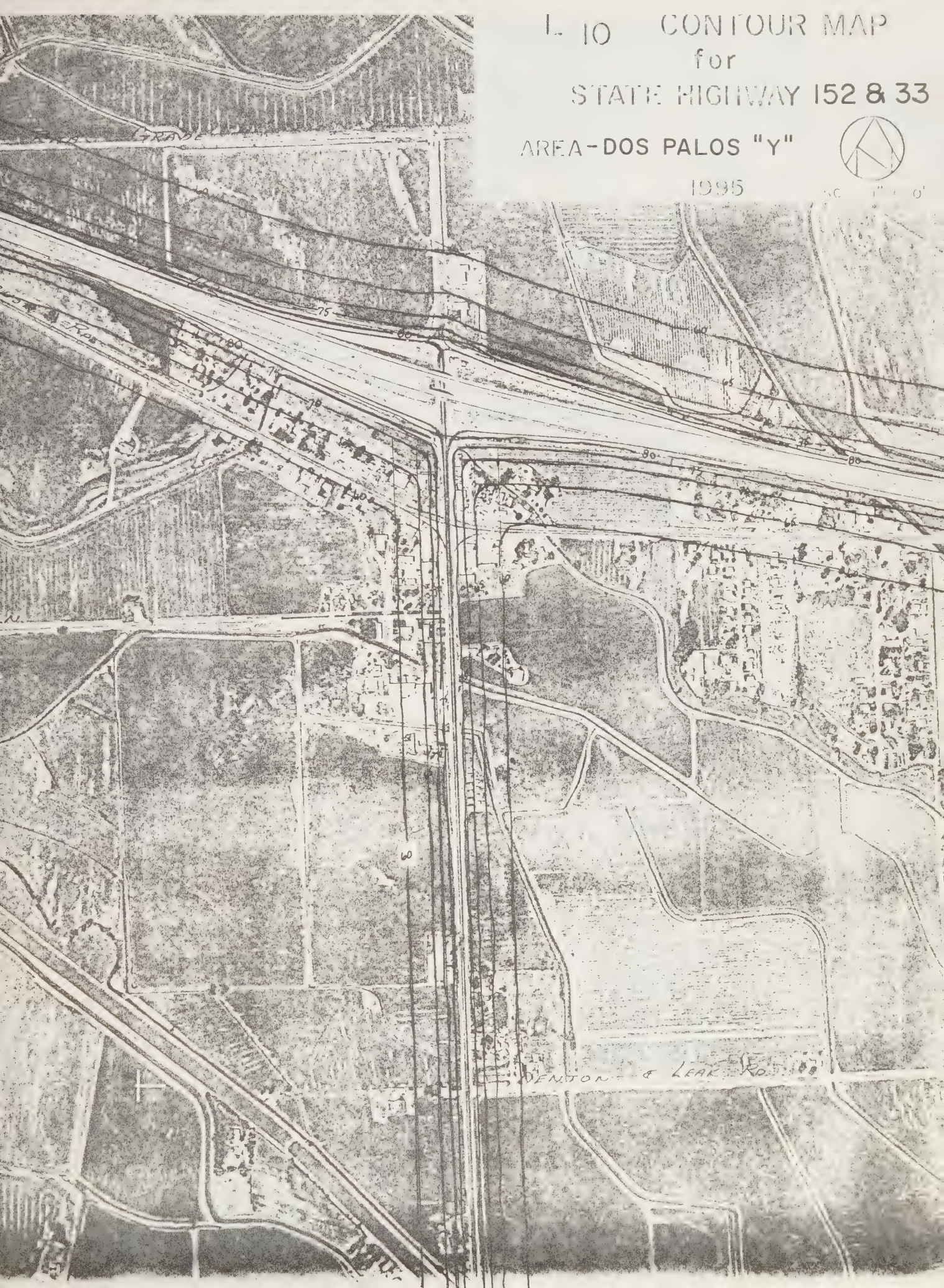
L 10 CONTOUR MAP
for
STATE HIGHWAY 152 & 33

AREA-DOS PALOS "Y"



1995

Scale 1" = 60'





L 10 CONTOUR MAP
for
STATE HIGHWAY 33

AREA - DOS PALOS

Contours extending through incorporated
areas are not to be construed as part
of an adopted city noise element



1973



VENICE

L 10 CONTOUR MAP
for
STATE HIGHWAY 33

AREA - DOS PALOS

Contours extending through incorporated
areas are not to be construed as part
of an adopted city noise element

1995



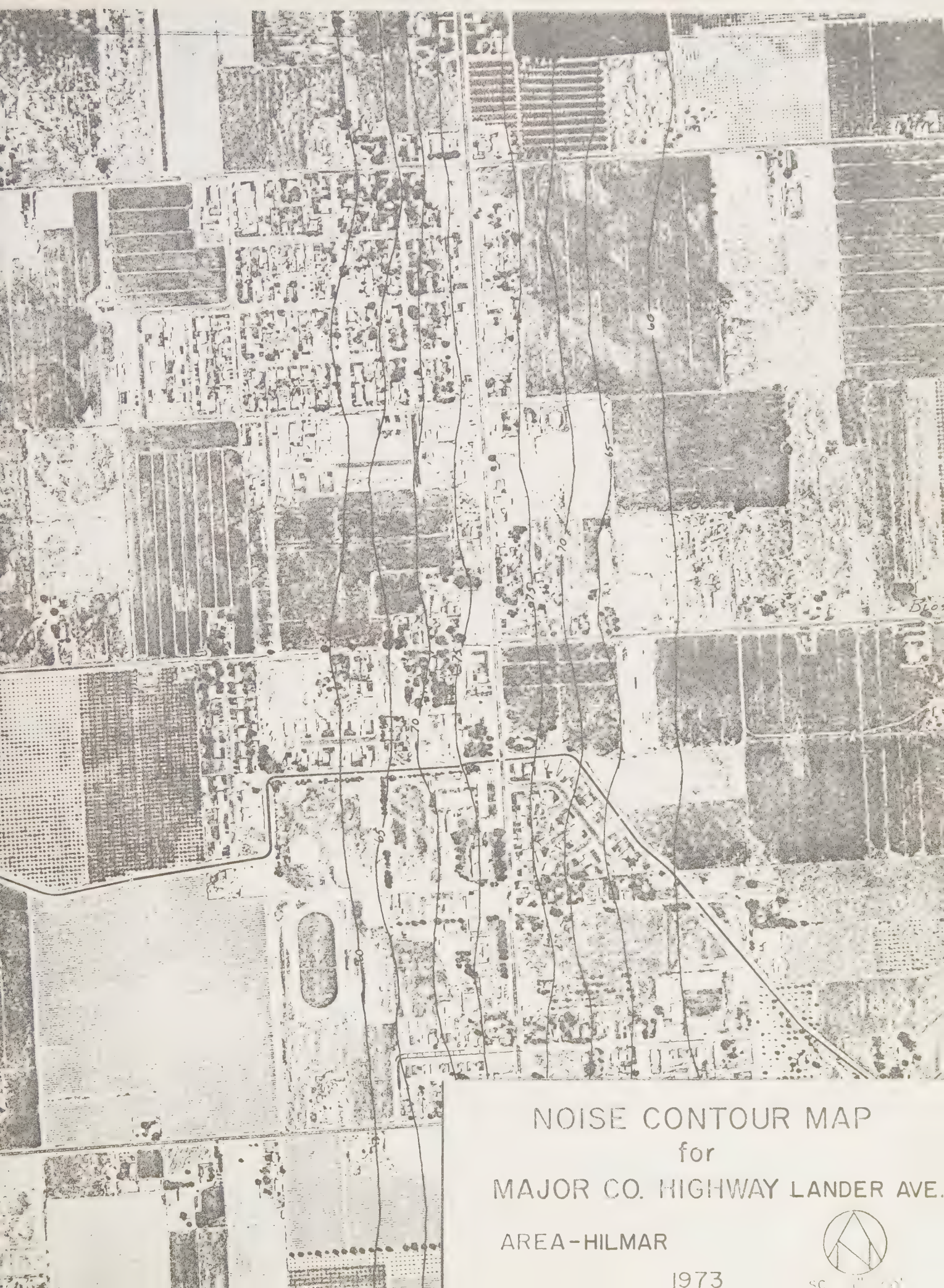
Scale 1" = 50'



NOISE CONTOUR MAP
for
MAJOR CO. HIGHWAY LEXINGTON
& SHAIN AVE'S.
AREA-SO. DOS PALOS

1973





NOISE CONTOUR MAP
for
MAJOR CO. HIGHWAY LANDER AVE.

AREA-HILMAR

1973



SC 111 101



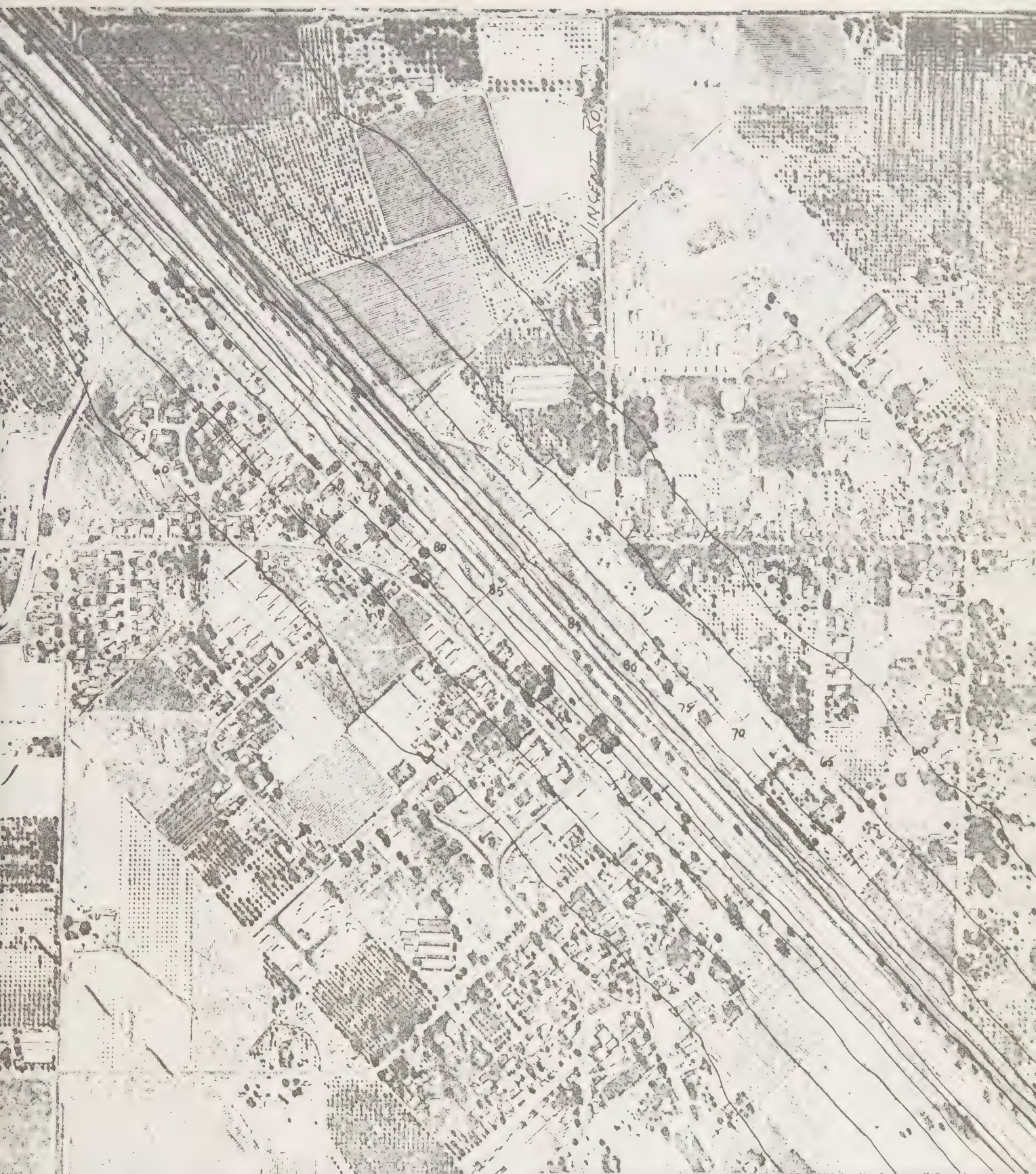
L 10 CONTOUR MAP
for
STATE HIGHWAY 99

AREA - DELHI

1973



SC. 1" = 660'



L 10 CONTOUR MAP
for
STATE HIGHWAY 99

AREA - DELHI

1995



SC. 1" = 660'



L 10 CONTOUR MAP
for
STATE HIGHWAY 99

AREA-LIVINGSTON

Contours extending through incorporated
areas are not to be construed as part
of an adopted city noise element

1973





L-10 CONTOUR MAP
for
STATE HIGHWAY 99

AREA-LIVINGSTON

Contours extending through incorporated
areas are not to be construed as part
of an adopted city noise element

1995



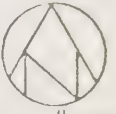
SC 111001

L 10 CONTOUR MAP
for
STATE HIGHWAY 99

AREA - ATWATER (west)

Contours extending through incorporated
areas are not to be construed as part
of an adopted city noise element

1973



SC. 1" = 660'



L 10 CONTOUR MAP
for
STATE HIGHWAY 99

AREA-ATWATER (west)

Contours extending through incorporated
areas are not to be construed as part
of an adopted city noise element

1995



SC. 1"=660'





L 10 CONTOUR MAP
for
STATE HIGHWAY 99

AREA-ATWATER (central)

Contours extending through incorporated
areas are not to be construed as part
of an adopted city noise element

1973



SC. 1" = 60'



L 10 CONTOUR MAP
for
STATE HIGHWAY 99

AREA - ATWATER (central)

Contours extending through incorporated
areas are not to be construed as part
of an adopted city noise element 1995



SC 11-650'



L 10 CONTOUR MAP
for
STATE HIGHWAY 99

AREA-ATWATER (east)

Contours extending through incorporated
areas are not to be construed as part
of an adopted city noise element

1973



SC 1" = 660'



L 10 CONTOUR MAP
for
STATE HIGHWAY 99

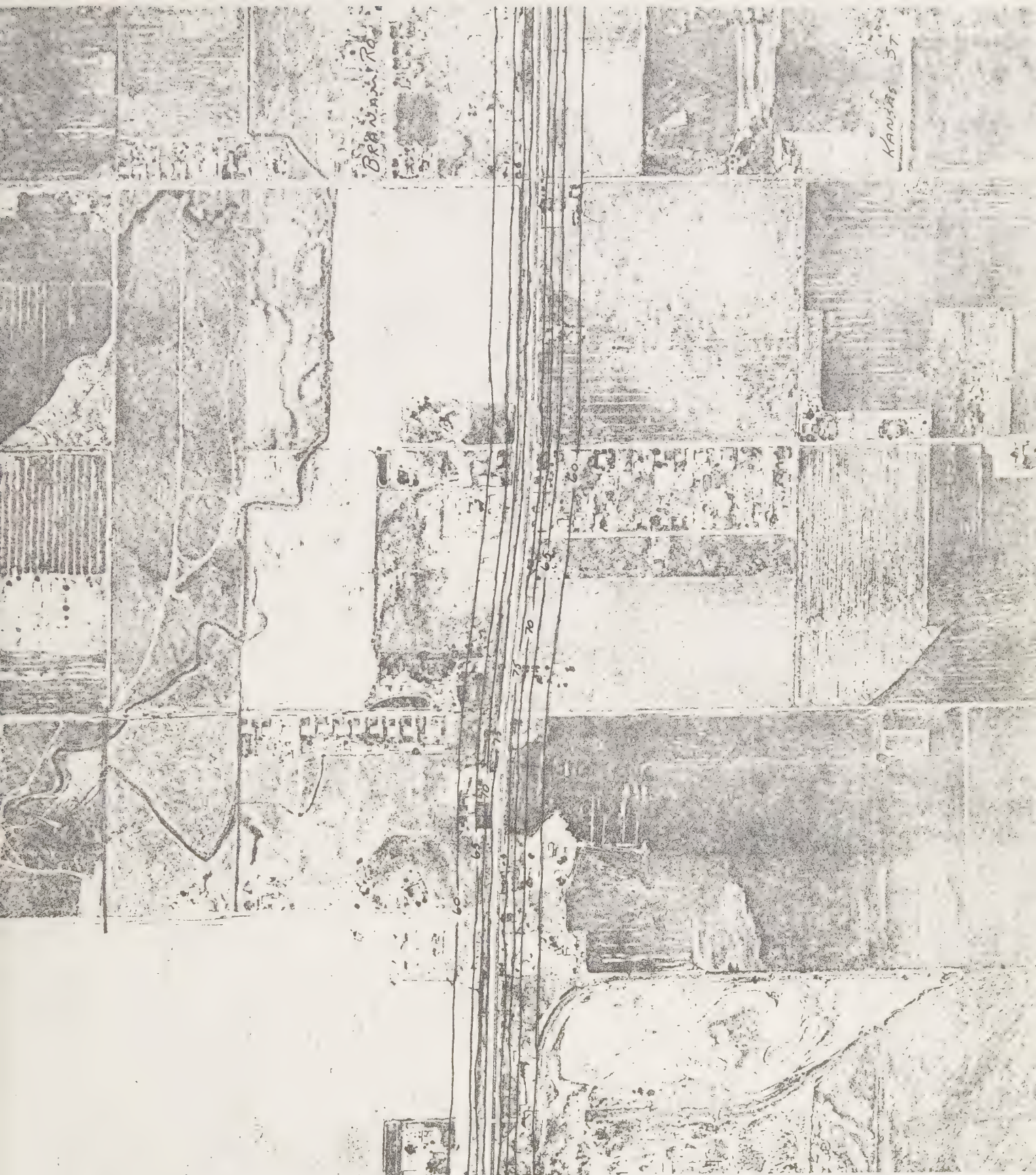
AREA-ATWATER (east)

Contours extending through incorporated
areas are not to be construed as part of an adopted city noise element

1995



SC 1" = 660'



L 10 CONTOUR MAP
for
STATE HIGHWAY 59

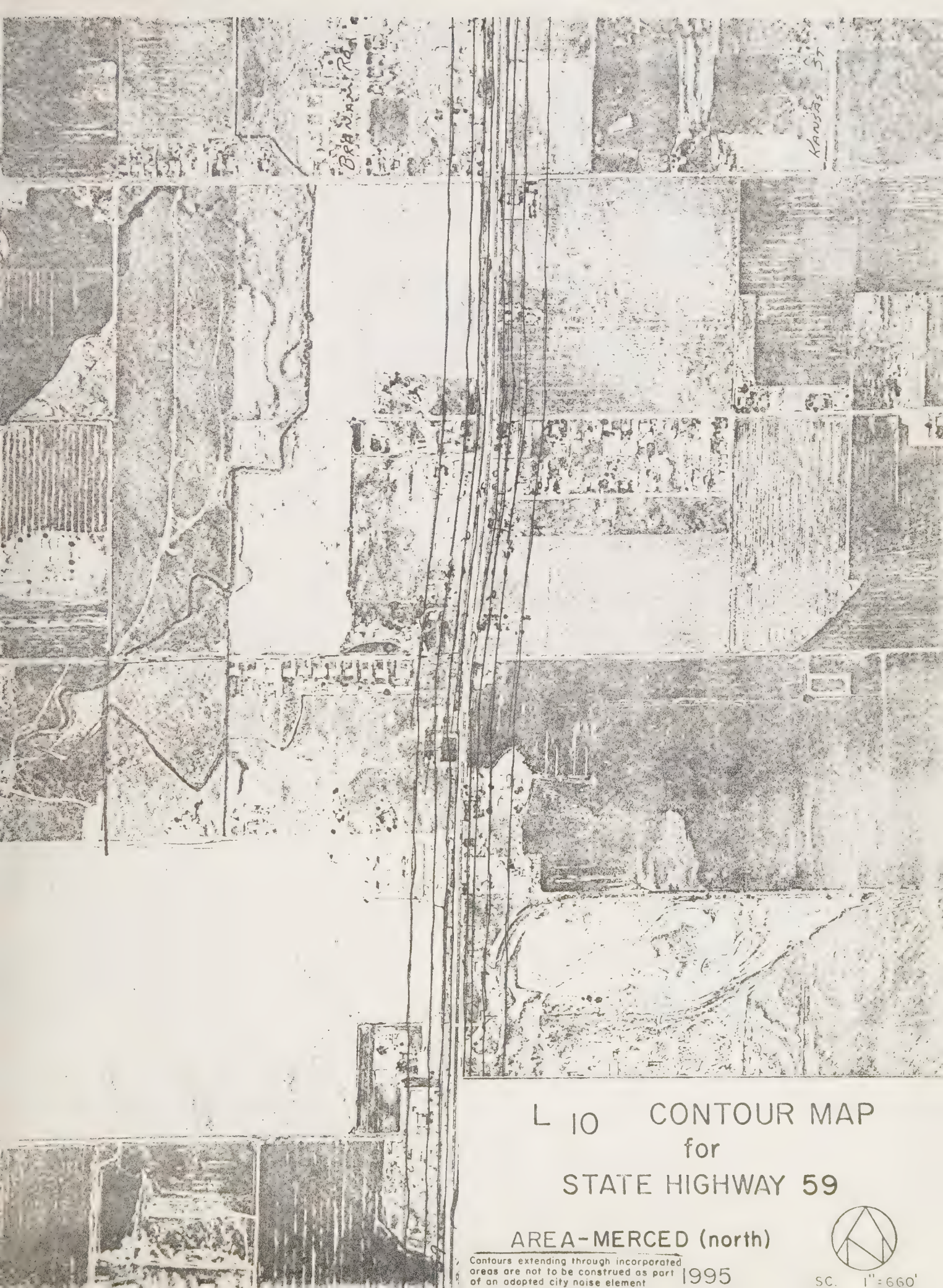
AREA-MERCED (north)

Contours extending through incorporated
areas are not to be construed as part
of an adopted city noise element

1973



Scale 1" = 660'



L 10 CONTOUR MAP
for
STATE HIGHWAY 59

AREA-MERCED (north)

Contours extending through incorporated
areas are not to be construed as part
of an adopted city noise element

1995



SC. 1"=660'



L 10 CONTOUR MAP
for
STATE HIGHWAY 140

AREA - MERCED (east)

Contours extending through incorporated
areas are not to be construed as part
of an adopted city noise element

1973



SC. 1" = 660'

PARSONS ST.



L 10 CONTOUR MAP
for
STATE HIGHWAY 140

AREA - MERCED (east)

Contours extending through incorporated
areas are not to be construed as part
of an adopted city noise element 1995



SC. 1" = 660'



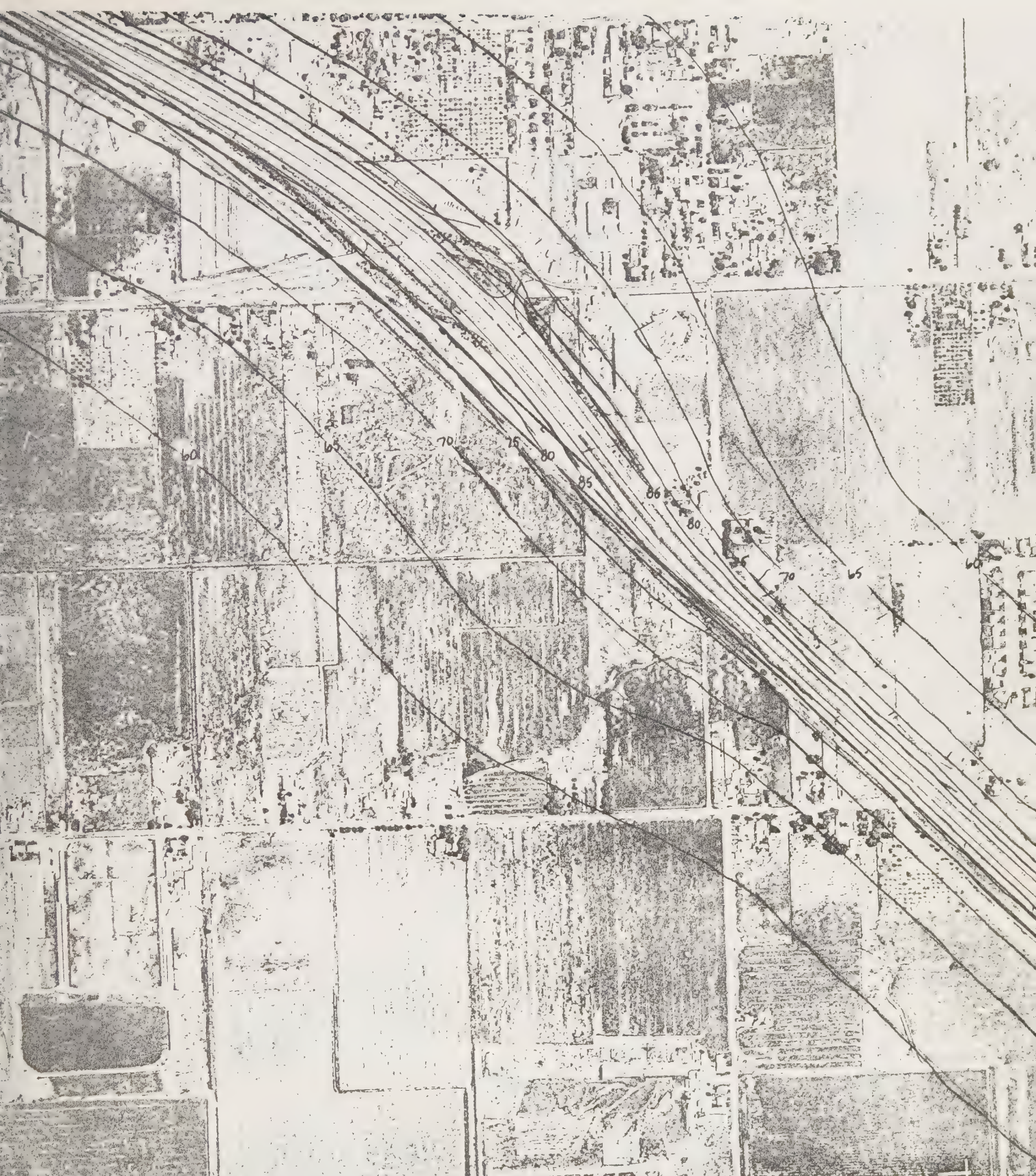
L 10 CONTOUR MAP
for
STATE HIGHWAY 99

AREA-MERCED(so. east)

Contours extending through incorporated
areas are not to be construed as part of an adopted city noise element 1973



SC. 1"=660'



L 10 CONTOUR MAP
for
STATE HIGHWAY 99

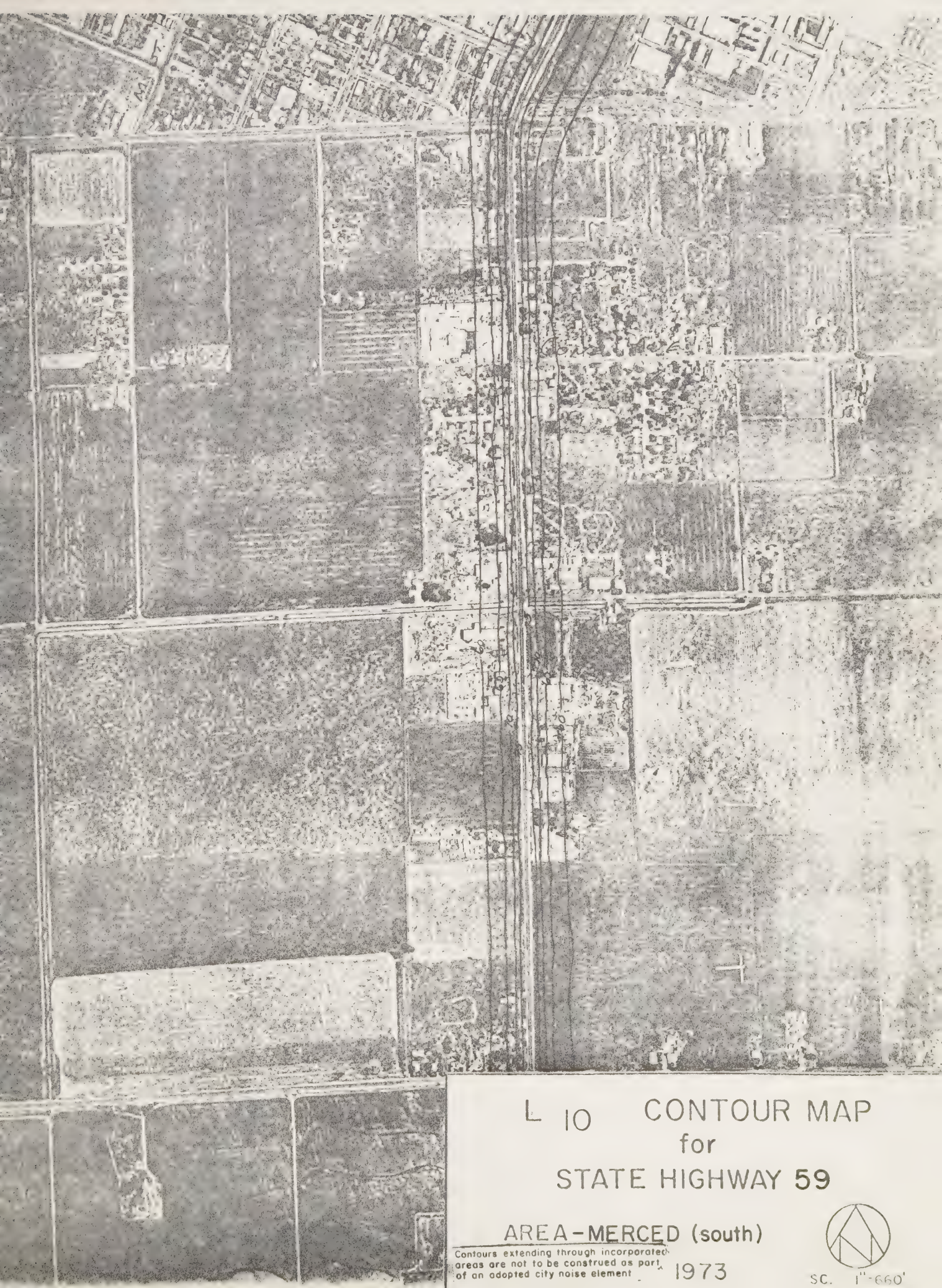
AREA - MERCED (so. east)

Contours extending through incorporated
areas are not to be construed as part
of an adopted city noise element

1995



SC. 1"=660'



L 10 CONTOUR MAP
for
STATE HIGHWAY 59

AREA - MERCED (south)

Contours extending through incorporated
areas are not to be construed as part
of an adopted city noise element

1973



SC. 1" = 660'



L 10 CONTOUR MAP
for
STATE HIGHWAY 59

AREA-MERCED (south)

Contours extending through incorporated
areas are not to be construed as part
of an adopted city noise element

1995



SC. 1"=660'

L 10 CONTOUR MAP
for
STATE HIGHWAY 99 & 140

AREA-MERCED (west)

Contours extending through incorporated
areas are not to be construed as part
of an adopted city noise element

1973



SC. 1"=660'



L 10 CONTOUR MAP
for
STATE HIGHWAY 99 & 140

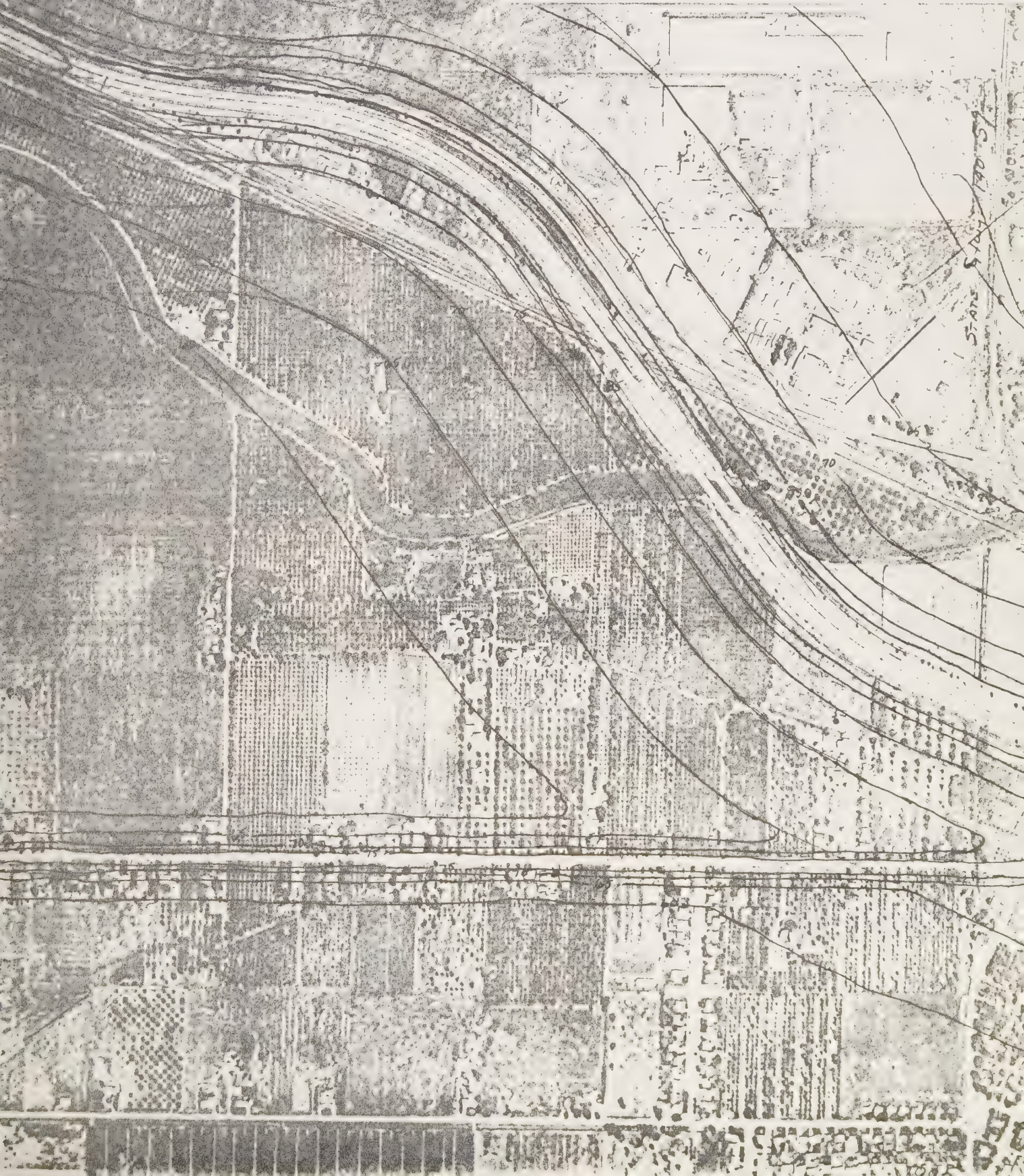
AREA-MERCED (west)

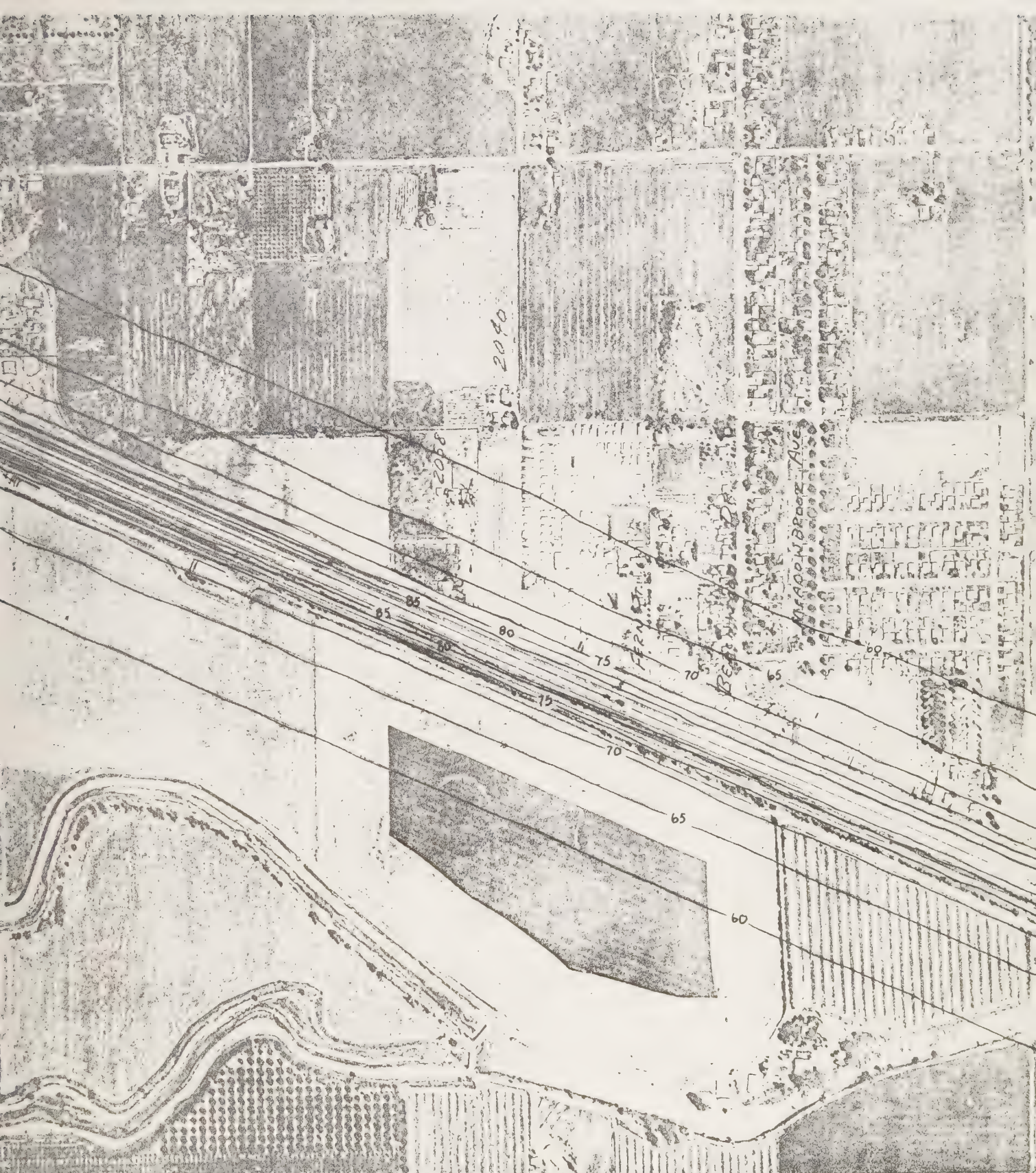
Contours extending through incorporated
areas are not to be construed as part
of an adopted city noise element

1995



SC. 1" = 660'





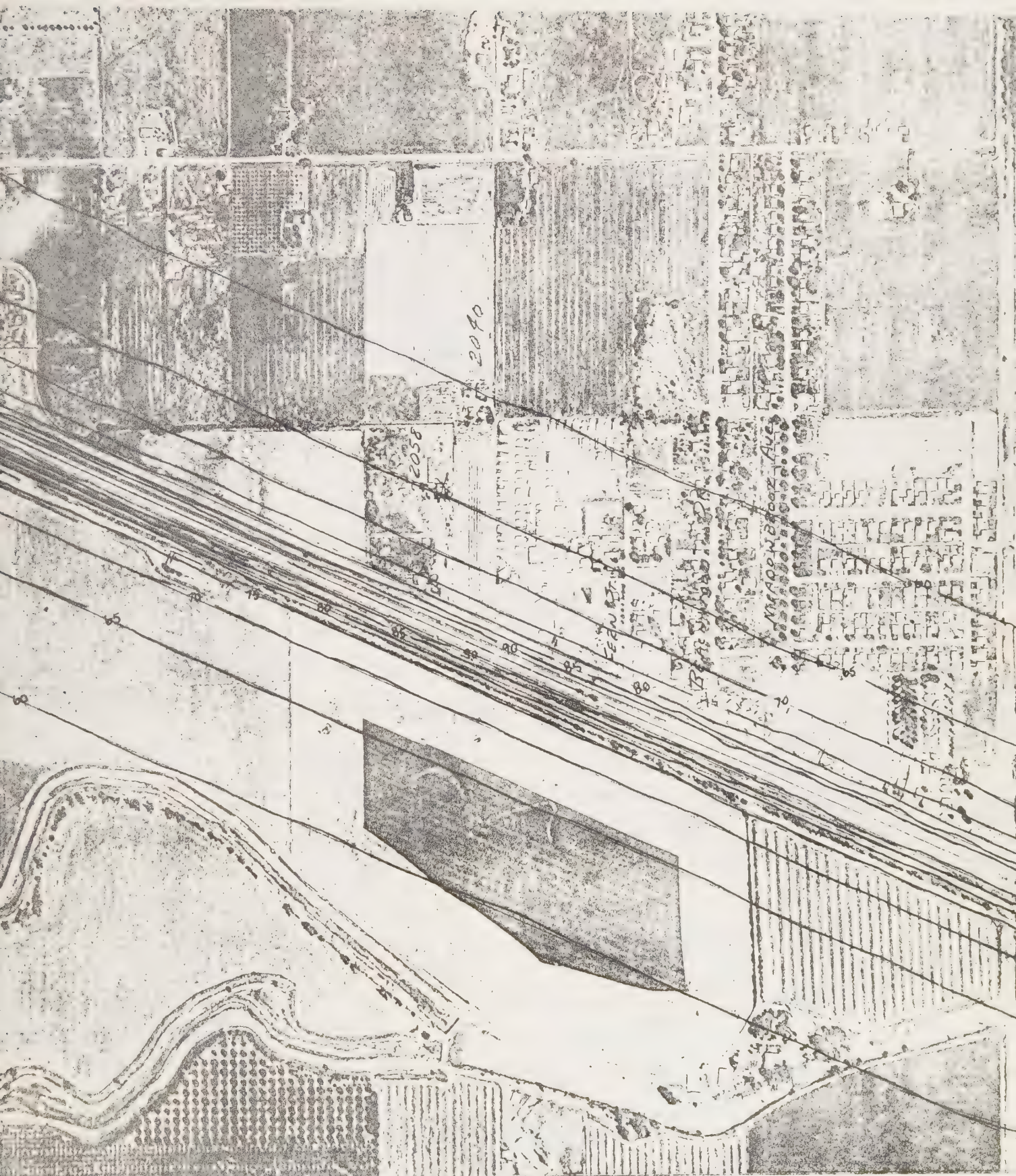
L 10 CONTOUR MAP
for
STATE HIGHWAY 99

AREA - MERCED (west)

1973



SC 1" = 60'



L 10 CONTOUR MAP
for
STATE HIGHWAY 99

AREA - MERCED (west)

1995



SC 1" = 360'



L 10 CONTOUR MAP
for
STATE HIGHWAY 59

AREA - SNELLING

1973



SC. 1"=160'



L 10 CONTOUR MAP
for
STATE HIGHWAY 59

AREA - SNELLING

1995

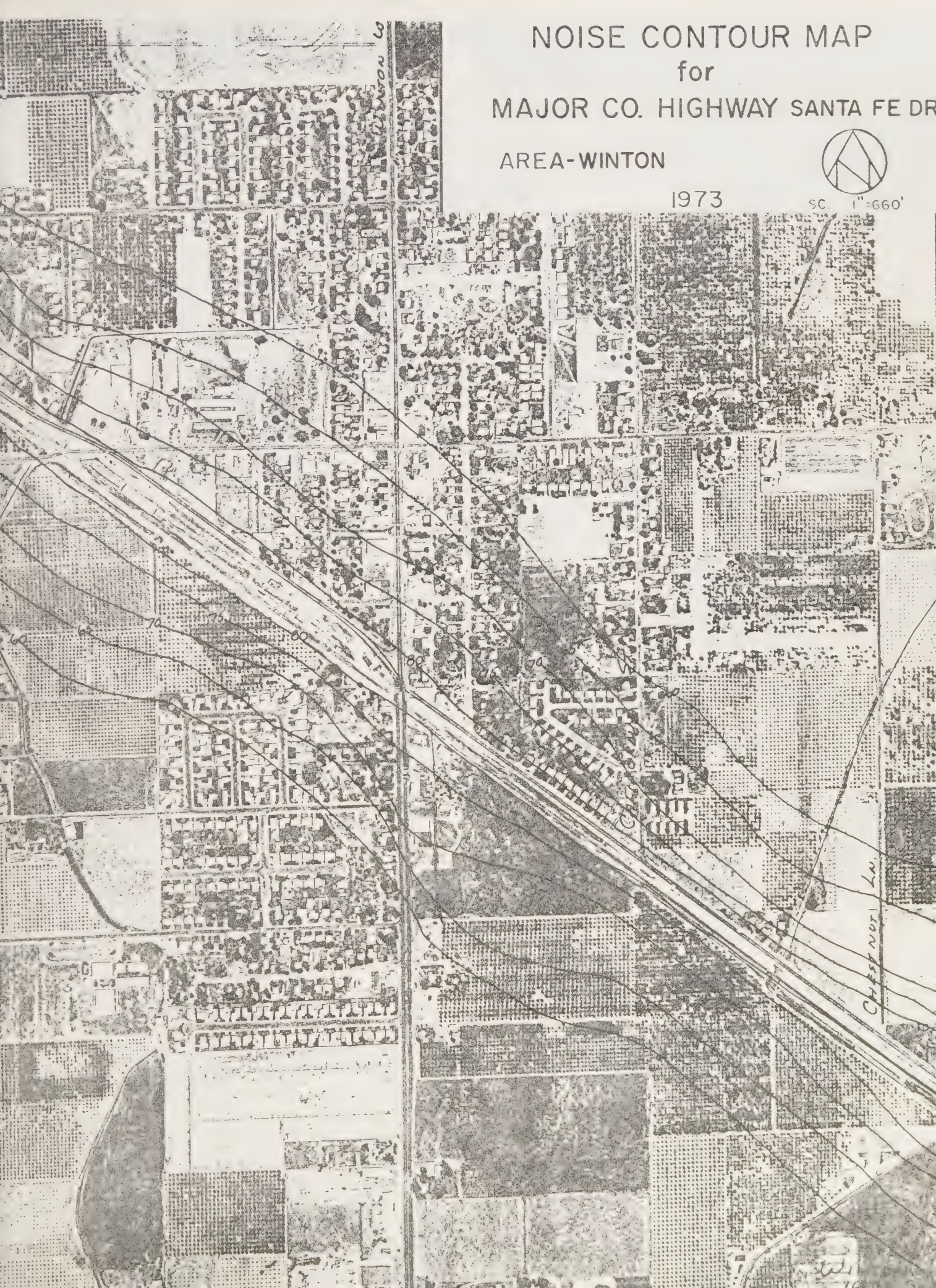


NOISE CONTOUR MAP
for
MAJOR CO. HIGHWAY SANTA FE DR
AREA-WINTON

1973



SC. 1"=660'





L 10 CONTOUR MAP
for
STATE HIGHWAY 140

AREA - PLANADA

1973





I. 10 CONTOUR MAP
for
STATE HIGHWAY 140

AREA - PLANADA

1995



SC 1" = 50'

NOISE CONTOUR MAP
for
MAJOR CO. HIGHWAY SANTA FE DR
AREA-LE GRAND

1973



APPENDIX B

Glossary

The following explanations of terms are provided to assist the reader in understanding some terms used in this element:

A-WEIGHTED SOUND LEVEL

The ear does not respond equally to frequencies, but is less efficient at low and high frequencies than it is at medium or speech range frequencies. Thus, to obtain a single number representing the sound level of a noise containing a wide range of frequencies in a manner representative of the ear's response, it is necessary to reduce, or weight, the effects of the low and high frequencies with respect to the medium frequencies. The resultant sound level is said to be A-weighted, and the units are dB. A popular method of indicating the units, db(A), is used in this element. The A-weighted sound level is also called the noise level. Sound level meters have an A-weighting network for measuring A-weighted sound levels.

AMBIENT NOISE LEVEL

The ambient noise level follows the usage of the word "ambient" throughout the environmental sciences (except acoustics). That is, the ambient noise level is that level which exists at any instance, regardless of source.

BAND CENTER FREQUENCY

The designated (geometric) mean frequency of a band of noise or other signal. For example, 1000 Hz is the band center frequency for the octave band that extends from 707 Hz to 1414 Hz, or for the third octave band that extends from 891 Hz to 1123 Hz.

BOOM CARPET

The area on the ground underneath an aircraft flying at supersonic speeds that is hit by a sonic boom of specific magnitude.

C-WEIGHTED SOUND LEVEL (dBC)

A quantity, in decibels, read from a standard sound-level meter that is switched to the weighting network labeled "C". The C-weighting network weights frequencies between 70 Hz and 4000 Hz uniformly, but below and above these limits frequencies are slightly discriminated against. Generally, C-weighted measurements are essentially the same as overall sound-pressure levels, which require no discrimination at any frequency.

COMMUNITY NOISE EQUIVALENT LEVEL (CNEL)

Community Noise Equivalent Level (CNEL) is a scale which takes account of all the A-weighted acoustic energy received at a point, from all noise events causing noise levels above some prescribed value. Weighting factors are included which place greater importance upon noise events occurring during the evening hours (7:00 p.m. to 10:00 p.m.) and even greater importance upon noise events at night (10:00 p.m. to 6:00 a.m.).

COMPOSITE NOISE RATING (CNR)

Composite Noise Rating (CNR) is a scale which takes account of the totality of all aircraft operations at an airport in quantifying the total aircraft noise environment. It was the earliest method for evaluating compatible land use around airports and is still in wide use by the Department of Defense in predicting noise environments around military airfields. Basically, to calculate a CNR value, one begins with a measure of the maximum noise magnitude from each aircraft flyby and adds weighting factors which sum the cumulative effects of all flights. The scale used to describe individual noise events is perceived noise level (PNdB); the term accounting for number of flights is $10 \log_{10} N$ (where N is the number of flight operations), and each night operation counts as much as 10 daytime operations. Very approximately, the noise exposure level at a point expressed in the CNR scale will be numerically 35 -37 dB higher than if expressed in the CNEL scale.

DECIBEL

The decibel (abbreviated dB) is a measure, on a logarithmic scale, of the magnitude of a particular quantity (such as sound pressure, sound power, intensity, etc.) with respect to a standard reference value. (0.0002 microbars for sound pressure and 10^{-12} watt for sound power)

FREQUENCY

The number of times per second that the sine-wave of sound repeats itself, or that the sine-wave of a vibrating object repeats itself. Now expressed in Hertz (Hz), formerly in cycles per second (cps).

GRADIENT

A variations of the local speed of sound with height above ground or other measure of distance causing refraction of sound. It is most commonly caused by rising or falling temperature with altitude or by differences in wind speed.

HERTZ

Unit of measurement of frequency, numerically equal to cycles per second.

L_{dn} METHOD

The noise exposure estimation techniques given in this method yield cumulative noise exposure information in terms of day-night average level (L_{dn}) noise contour values. The L_{dn} values so determined are essentially identical to the community noise equivalent level (CNEL) noise standards presently specified by the Department of Housing and Community Development, the only distinction being that L_{dn} divides the day into two time periods, whereas CNEL utilizes three such periods. Both weight day and night time events identically; however, CNEL incorporates an additional weighting for events occurring in the evening between 7:00 p.m. and 10:00 p.m. L_{dn} thus represents a logical simplification of CNEL with more convenient noise source activity data gathering and no appreciable loss of accuracy.

L₁₀ LEVEL

The sound level exceeded 10% of the time. Corresponds to peaks of noise in the time history of environmental noise in a particular setting.

LEVEL

The value of a quantity in decibels. The level of an acoustical quantity (sound pressure or sound power), in decibels, is 10 times the logarithm (base 10) of the ratio of the quantity to a reference quantity of the same physical kind.

NOISE EXPOSURE FORECAST (NEF)

Noise Exposure Forecast (NEF) is a scale (analogous to CNEL and CNR) which has been used by the federal government in land use planning guides for use in connection with airports.

In the NEF scale, the basic measure of magnitude for individual noise events is the effective perceived noise level (EPNL), in units of EPNdB. This magnitude measure includes the effect of duration per event. The terms accounting for number of flights and for weighting by time period are the same as in the CNR scale. Very approximately, the noise exposure level at a point expressed in the NEF scale will be numerically about 33 dB lower than if expressed in the CNEL scale.

NOISE POLLUTION LEVEL (L_{Np} or NPL)

A measure of the total community noise, postulated to be applicable to both traffic noise and aircraft noise. It is computed from the "energy average" of the noise level and the standard deviation of the time-varying noise level.

PERCEIVED NOISE LEVEL (PNL)

A quantity expressed in decibels that provides a subjective assessment of the perceived "noisiness" of aircraft noise. The units of Perceived Noise Level are Perceived Noise Decibels, PNdB.

SONIC BOOM

The pressure transient produced at an observing point by a vehicle that is moving past (or over) it faster than the speed of sound.

SOUND PRESSURE

(1) The minute fluctuations in atmospheric pressure which accompany the passage of a sound wave: the pressure fluctuations on the tympanic membrane are transmitted to the inner ear and give rise to the sensation of audible sound.

(2) For a steady sound, the value of the sound pressure averaged over a period of time.

(3) Sound pressure is usually measured (a) in dynes per square centimeter (dyn/cm^2), or (b) in newtons per square meter (N/m^2). $1 \text{ N}/\text{m}^2 = 10 \text{ dyn}/\text{cm}^2 = 10^{-5}$ times the atmospheric pressure.

SOUND PRESSURE LEVEL

The root-mean-square value of the pressure fluctuations above and below atmospheric pressure due to a sound wave; expressed in decibels re a reference pressure of 0.0002 microbars (2×10^{-5} Newtons per square meter).

SOUND TRANSMISSION CLASS (STC)

A measure of sound insulation provided by a structural configuration. Expressed in decibels, it is 10 times the logarithm to the base 10 of the reciprocal of the sound transmission coefficient of the configuration.

SPEED (VELOCITY) OF SOUND IN AIR

The speed of sound in air is 344m/sec or 1128 ft/sec at 78°F.

TRAFFIC NOISE INDEX TNI

A measure of the noise environment created by vehicular traffic on highways; it is computed from measured values of the noise levels exceeded 10 percent and 90 percent of the time.

ULTRASONIC

Pertaining to sound frequencies above the audible sound spectrum (in general, higher than 20,000 Hz).

VIBRATION ISOLATOR

A resilient support for machinery and other equipment that might be a source of vibration, designed to reduce the amount of vibration transmitted to the building structure.

APPENDIX C

HUD Guidelines for Evaluation of Exposure to Railway Noise

The distances in the table below were arrived at with the assumption that there are 10 or more nighttime (10:00 p.m. - 7:00 a.m.) railway operations.

If a railway has 10 or more nighttime operations, proceed to the table for an immediate evaluation of the site's exposure to noise from that railway.

But

if a railway has fewer than 10 nighttime operations, multiply the distance from the site to that railway by the appropriate adjustment factor; then proceed to the table.

Number of Nighttime Railway Operations	Adjustment Factor
1 - 2 operations	3.3
3 - 5 operations	1.7
6 - 9 operations	1.2

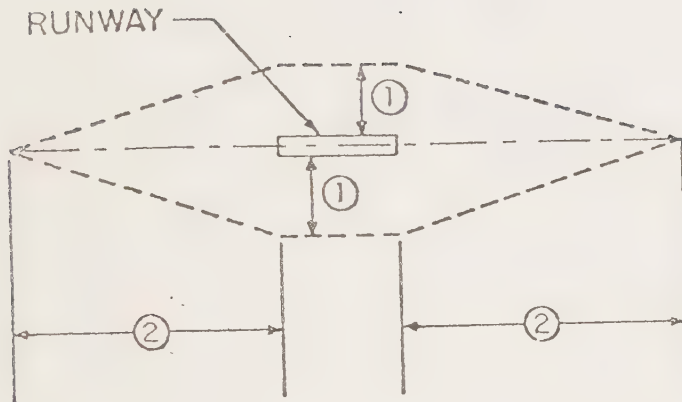
SITE EXPOSURE TO RAILWAY NOISE

Distance from Site to Right-of-Way: (Possibly adjusted for number of nighttime operations)		Acceptability Category
Line-of-Sight Exposure	Shielded Exposure	
More than 3000 ft	More than 500 ft	Clearly Acceptable
Between 601 and 3000 ft	Between 101 and 500 ft	Normally Acceptable
Between 101 and 600 ft	Between 51 and 100 ft	Normally Unacceptable
Less than 100 ft	Less than 50 ft	Clearly Unacceptable

APPENDIX D

HUD Guidelines for

Noise Exposure Forecast (NEF) Determination



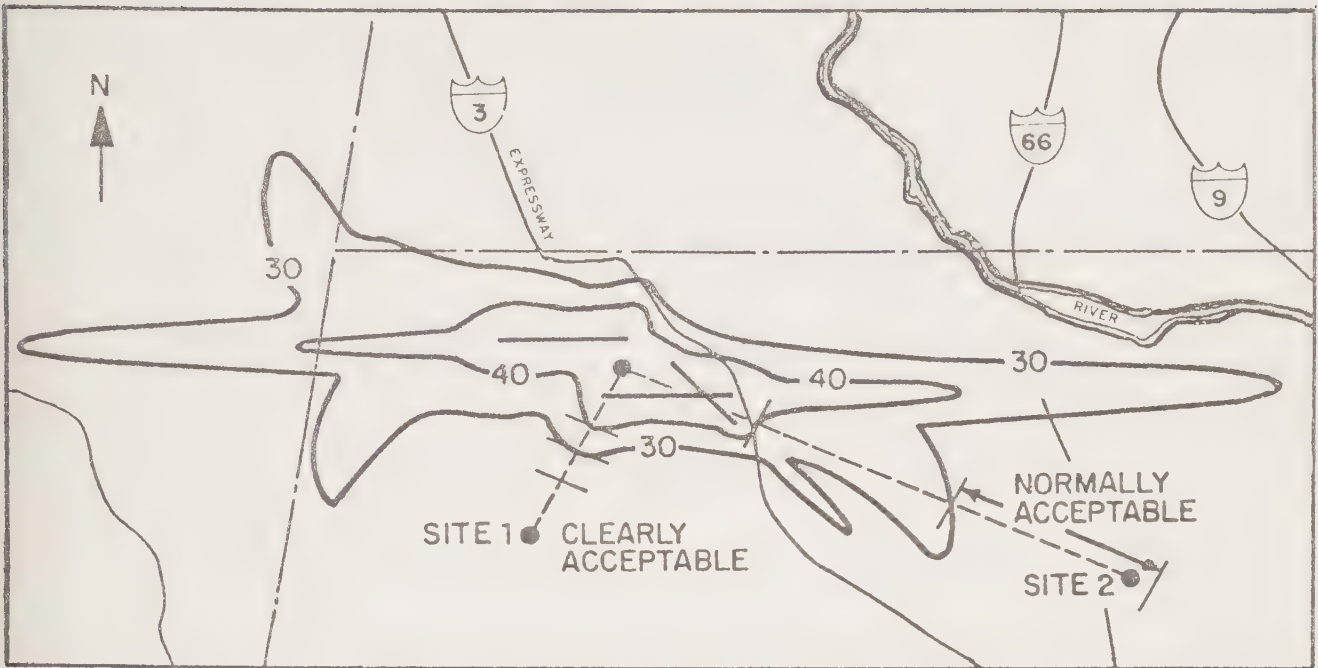
If NEF or CNR contours are not available, determine the effective number of operations for the airport as follows. Multiply the number of nighttime jet operations by 17. Then add the number of daytime jet operations to obtain an effective total. Any supersonic jet operation automatically places an airport in the largest category of the table below, which governs noise acceptability.

On a map of the area which shows the principal runways, mark the locations of the site and of the center of the area covered by the principal runways. Then, using the distances below, you can construct approximate NEF-40 and NEF-30 contours for the major runways and flight paths most likely to affect the site. Again use the first table to evaluate the site's exposure to aircraft noise.

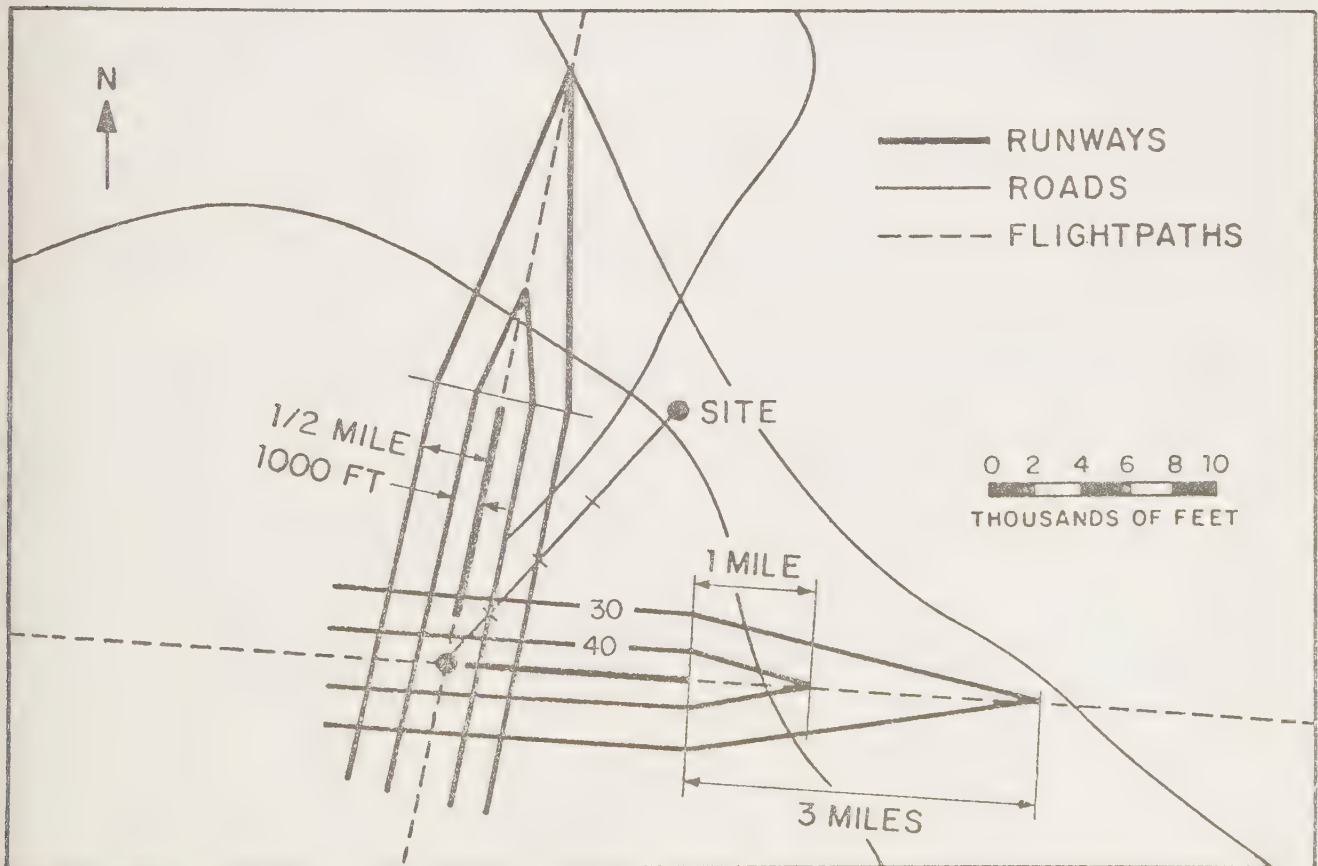
DISTANCES FOR APPROXIMATE NEF CONTOURS

Effective Number of Operations	Distances to NEF 30 Contour		Distances to NEF 40 Contour	
	①	②	①	②
0 - 50	1000 ft	1 mile	0	0
51 - 500	1/2 mile	3 miles	1000 ft	1 mile
501 - 1300	1 1/2 miles	6 miles	2000 ft	2 1/2 miles
More than 1300 or any supersonic jet operations	2 miles	10 miles	3000 ft	4 miles

APPENDIX D



Example of NEF Contours



Example of Approximate NEF Contours Drawn for An Airport With An Effective Number of Operations Between 51 and 500.

APPENDIX E

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